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Lighting for Art Galleries and Public Buildings

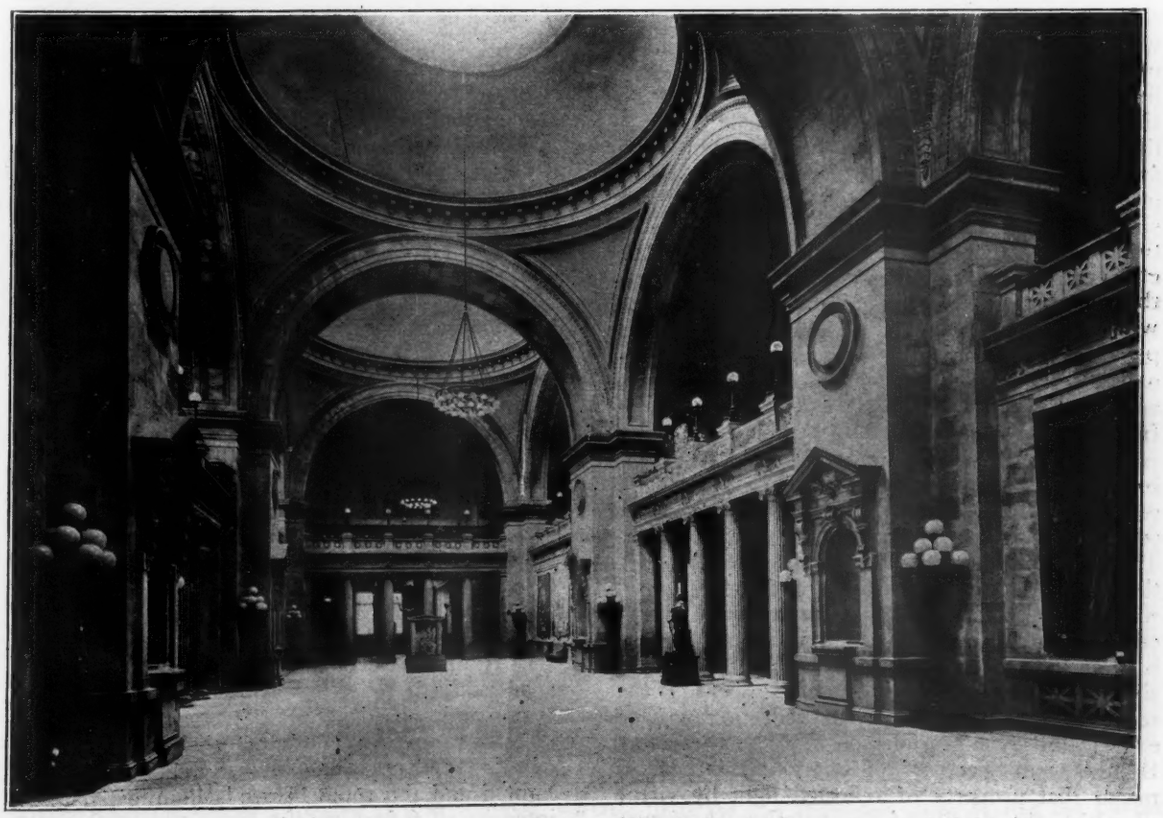
Color Quality of Light Plays Important Part in Illumination of Paintings, While Direction Is a Most Vital Factor with Statuary — Architectural Effects Are Enhanced or Lost by Illumination

By E. H. PARKER

The study of artificial lighting is not only a very interesting subject, but it is one that requires a great deal of planning and forethought on the part of the illuminating engineer if satisfactory results are to be obtained. In fact, from a recent investigation of modern lighting equipment in our public buildings many examples were found which served to show that the illuminating engineer had an excellent opportunity to show what an important tool light really is.

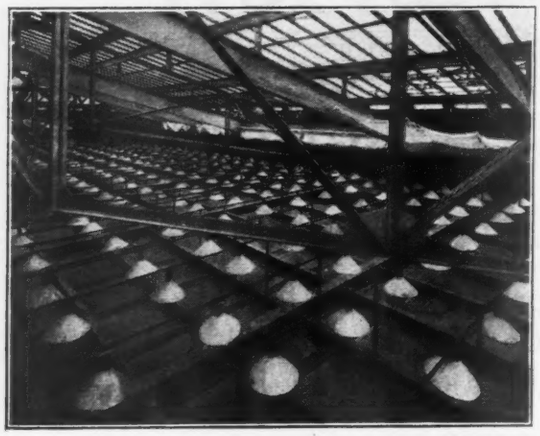
Co-operation is a familiar word today, and there is perhaps no one field which offers a better opportunity for a close co-operation than between the illuminating engineer and the architect in the design and the construction of our art galleries or the finely finished interiors of libraries, theaters and public institutions. Few people have ever stopped to realize the importance that light plays in the illumination of buildings of this nature, not only from the lighting standpoint, but from the point that it does much toward accentuating the beauty and architectural features of the edifice.

Many of our art galleries are beautifully designed and are more or less monumental in construction, representing large investments en-



View Showing Method of Illuminating Foyer of Metropolitan Museum of Art—Many Types of Building Might Be Improved in Appearance by Such Treatment.

dowed to the study of art. Here are exhibited priceless collections of paintings and wonderful works of sculpture collected together and suitably arranged so that the public may view and study them at leisure. What could be more appropriate than a pleasing and efficient lighting installation which will tend to accentuate the beauty of the building and at the same time present the exhibits in a manner pleasing to the artists?



Typical Installation of Skylight Illumination, Using 60-Watt Lamps in Conical Reflectors.

The illumination of an art gallery may be divided into two divisions, each with its important features to be considered: First, we have the illumination of the painting gallery, where color is of the utmost importance and, second, we have the lighting of the statuary gallery where direction of light plays a very important and very necessary role.

In the painting gallery are found priceless works of art which have usually been produced under daylight conditions, so that in planning a lighting installation daylight conditions should be simulated as nearly as possible in order to give the work an appearance similar to that which the artist had in mind. The direction of light should, in general, be from overhead. However in special cases where individual or localized illumination is planned it may be possible to enrich the effect of a painting by locating the light source so that the direction of the artificial light conforms with the predominating direction of light in the painting. In a case of this nature small individual reflectors equipped with 25 or 40-watt lamps are generally used and are attached directly to the frame of the painting.

However, the most common method of illuminating paintings or pictures is by means of a continuous metal trough reflector housing 40 or 60-watt lamps spaced from 10 to 14 ins. apart. These reflectors are especially designed to give the correct distribution of light and are equipped with a skirt so that the light source is well shielded from the eyes of a spectator viewing the exhibit from a position back of the reflector. Considerable care must be exercised in locating the reflector or annoying specular reflection will be experienced from various positions in the room. By the term specular reflection in this case is meant that property of reflected light by virtue of which the details of the painting or picture are blotted out or made undiscernible by the reflection of the light source on the canvas or the glass covering of the work. To avoid a condition of this nature the reflector should be placed well over the work, but not high enough to cast a shadow of the frame upon the picture, and far enough in front to illuminate the surface uniformly.

Pictures of a dark nature should be placed at the top where they will receive a larger proportion of the light and thus tend to give the gallery a more uniform appearance. The walls and background should be of low reflecting power and of a neutral tone which will avoid reflections and tend to cause the paintings to stand out from the background.

Artificial Light Has Influence on Evident Color of Paintings.

Under most systems of artificial illumination the color value of a painting will shift further towards the red than when illuminated by daylight. A deep yellow would consequently appear nearer the orange; a bluish purple would appear nearer the black, while a red would seem to be brighter. Thus, it can be seen that to obtain the true effect of a picture a careful consideration of the lighting equipment is necessary.

Recently lamp manufacturers have put on the market a lamp known as the "Daylight" lamp which is made with a bulb of special blue glass and designed to give light of approximately daylight quality. Lamps of this type are well adapted to art gallery lighting or for use in places where it is of importance to show colors in their true tone.

Another method of illuminating painting galleries, which is certainly desirable when the construction of the building permits, is from above the skylight of the room. Not only can a better lighting effect be obtained, but the appearance of the room without fixtures is much more attractive. The type of reflector employed and the spacing and hanging height of the units above the glass will depend upon the construction of the skylight. Where the sub-skylight is supported by a multiplicity of steel girders and beams placed close together the lamps and reflectors will necessarily have to be installed close together to avoid casting shadows upon the glass of the skylight. On the other hand if there is no overhead construction in the way larger lamps may be employed. Many of the galleries of the Boston Art Museum are well adapted for this type of lighting and are illuminated from above the skylight by means of 750-watt lamps in porcelain enameled steel reflectors of the angle type. The reflectors are installed 4 ft. above the 0.375 in. ground glass of the skylight and so directed that they throw light upon the opposite walls and at the same time provide ample downward diffusion of light.

A view of the lighting equipment above one of the galleries of the Metropolitan Art Museum is shown in an accompanying illustration. Here cone shaped reflectors equipped with 60-watt lamps and spaced about 3 ft. apart are attached directly to the iron conduit. With an installation of this type the glass of the skylight is uniformly lighted and the room below is illuminated to an intensity of 6 foot-candles.

(To Be Continued.)

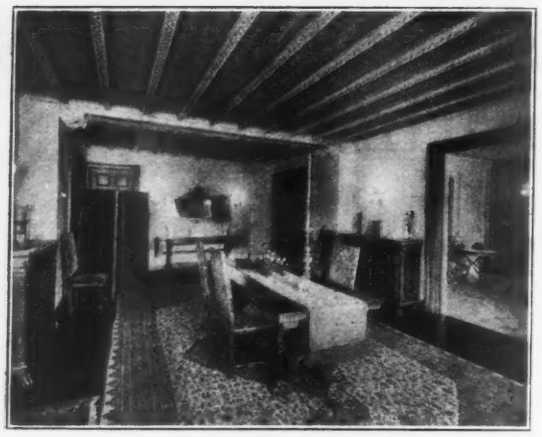
Illuminating Features in Luxurious Chicago Apartment

Variety of Treatment in Different Rooms Obtained by Use of Chandeliers, Brackets and Portable Equipment—Glass, Silk and Parchment Employed for Shades—Colored Bulbs Prove Useful

Residence lighting has been characterized as the mother of the electrical industry, but it seems quite evident that the industry after growing up has failed to give to residence lighting the consideration and attention which it should merit. Other fields of lighting have received an enormous amount of attention and have been made the subject of the life study of many illuminating engineers, while residence lighting has been allowed almost to drift by itself. Architects, builders, electrical contractors, fixture men, decorators and the central station company all make contact in some fashion with the home owner, but it seems that there has been no organized effort on the part of these various interests to provide suitable and artistic home illumination. To be sure many homes have been provided with illumination planned to enhance the ornamental features of the interior decoration and to play upon the moods of the householder, but the potentiality of lighting in this field has been sadly neglected. There is no real and valid reason why this should be so, for the average individual is almost invariably willing to pay for the comforts which he enjoys, and there is no question but that a vast amount of comfort may be obtained from proper illumination in the home. The accompanying illustrations show, after a fashion, what has been accomplished in one instance in the matter of home lighting. The views were taken in a 14-room apartment located in the North Shore district of Chicago, the interior decorations and lighting equipment having been arranged to suit the taste of the occupants of the apartment. Chandeliers, wall brackets, table lamps, floor lamps, reading lamps and boudoir lamps have been used to meet the requirements of the various spaces to be served.

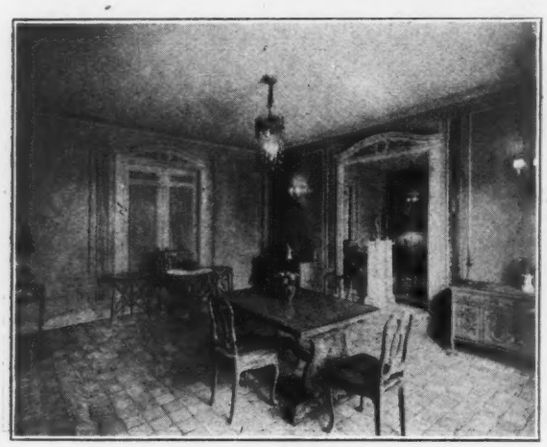
The rooms in this particular apartment are varied in size and shape so that different treatments have been required in order to produce satisfactory results. It is interesting to note in this connection that the different treatments required make it possible to add to the charm of the home by introducing variety in the lighting equipment. The living room, as may be noted from the accompanying illustration, is quite large. The ceiling is finished in a light cream tone ap-

Living Room Illuminated by Means of Wall Brackets, Portable Units and One Chandelier, Using Frosted and Colored Lamps.



Candle-Type Wall Brackets With Parchment Shields in Dining Room.

proaching near to the white, while the walls are finished in oak panels and the floor is covered with a rug of very dark tone. The furnishings are also dark so that a considerable quantity of light can be used with good effect. Ten wall brackets, one chandelier, three table lamps and a reading lamp comprise the fixtures provided for this room, the chandelier not being shown in the illustration because of the fact that it was suspended too near to the end of the room to come within the range of the photograph. The chandelier itself as may be seen in the illustration of the book room, which lies just beyond the living room, carries four lights in aged ivory candle sockets, the lights being shielded by rose-tinted shades. The chandelier body is of heavy bronze construction and of a design quite in keeping with the general character of interior furnishings in both the living room and the book room. The circuit of this chandelier is controlled by a flip switch in the doorway between the gallery and the book room, the switches for the other lights in the book room and for certain light in the gallery being located at the same point. The table lamp in the near foreground of the illustration of the living room has an old-gold silk shade supported on a bronze stem, three 25-watt amber lamps controlled by individual pull chains comprising the actual lighting equipment. Two table lamps shown at the rear of the same room have silk shades of a similar tone and antique



Breakfast Room Lighted by Means of Brackets and a Chandelier.

bronze standards on marble bases. Two 25-watt bulbs each are provided for these lamps. The reading lamp shown on the right has a suspended colored-glass shade, the glass panels being mounted in an ornamental framework and inclosing a 50-watt "Fireside Glow" bulb. Silk shades of an old-gold tone are employed in connection with the 10 wall brackets in this room. The bulbs, which are frosted and of 25-watt capacity, are mounted in tapered aged-ivory candle sockets and each bracket is provided with an individual switch designed and built in as an inconspicuous part of the bracket itself. In addition to this switch the wall brackets are controlled by circuit switches in the archway between the living room and the gallery. Just beyond the doorway at the far end of the living room lies the dining room, the long dimension of which is at right angles to that of the living room.

Equipment in Dining Room Produces Effect of Candle Illumination.

The walls of the dining room are of a light tan shade, the ceiling being somewhat darker. The main body of the rug covering the greater portion of the floor is fairly light, but the floor

Book Room Provided With Wall Brackets and Two Portable Lamps.

itself and the border of the rug are dark. The furniture is of walnut and the wood trim of the room itself is of golden oak. This room is lighted by means of six 2-light wall brackets, each bracket being provided with two 25-watt frosted bulbs. The brackets themselves are of hand-carved wood and support old-ivory candle sockets. Shields of hand-painted parchment cover the two lamps in each of the wall brackets. The colors used and the figures in the design have been selected to harmonize somewhat with the ceiling decorations and the furnishings employed. It may be noted from the illustration of the dining room that candle sticks are provided for the dining table itself to carry out the impression of candle illumination. In fact, the candles in these two stands are frequently lighted at meal times. It may be noted also that a pleasing effect is produced by the two brackets mounted at either side of the gold-framed mirror suspended over the silver table at the far end of the room. The brackets mounted immediately over the antique walnut silver chests at either side of the room serve the double purpose of providing

general illumination and also local illumination to set off the pieces that may be arranged on the top of the chests. The doorway that may be noted to the left of the dining room leads into the breakfast room, the book room, the living room, and the dining room forming almost, in fact, one great room separated into different parts only by what might be termed partial partitions.

The breakfast room, as might be expected, is finished in much lighter tones than the other spaces. The floor of this room is done in weathered blue and white tile with a figured border containing a small amount of green. A light cream tone was selected for the ceiling which was trimmed with a conventional border design similar to the design at the sides of the doors and wall panels. The walls themselves are finished in canary yellow, the furniture all being of old ivory with chairs upholstered in blue and old gold. The lighting fixtures in the breakfast room consist of four 2-light wall brackets and one chandelier. The wall brackets are of bronze worked in a floral design, and the parchment shades covering the 25-watt frosted lamps supported on old ivory candle sockets are trimmed with hand painted bluebird designs. The chandelier is made up of a framework interwoven with a vine bearing leaves and colored flowers. All finishings are in natural colors, creating the impression that the piece itself is a hanging basket supporting a living vine. The lighting units themselves in the chandelier consist of six 25-watt tubular lamps with candelabra bases, and the supporting sockets are of candle type and are finished in old ivory.

The book room already mentioned as being located at the end of the living room is illuminated partially by the chandelier at the end of the living room and partially by four other lighting units within the room itself. Two of the lighting units are wall brackets identical in design with the wall brackets employed in the living room. A third unit consists of a silk shaded bronze table lamp conveniently located on the reading desk. The fourth unit consists of a 3-arm stand lamp fitted with 25-watt bulbs and hand-painted glass shades shaped somewhat in the form of a budding rose. All of these fixtures are plainly shown in the illustration of the book room.

Floor Lamps in Imitation of Candle Stands Used in Gallery.

A distinctly different mode of treatment has been employed in the illumination of the gallery affording connection between the entrance vestibule and the various rooms of the apartment. The gallery itself is lighted entirely by means of four hand-wrought floor lamps. Two of these lamps, located one at either side of a table facing the main entrance, are provided with massive bronze supporting stands mounted on marble bases. The other two lamps, one at either end of the gallery, are much lighter in construction, being finely molded of hand-wrought metal. The bulbs employed, five to each unit, are mounted in rather long old ivory sockets and are all of a deep amber color giving off a light of warm tone. A hanging fixture made in the form of an old-fashioned oil lamp serves to illuminate the archway at either end of the gallery. Aside from this unit there is also a silk-shaded pedestal lamp in the archway leading from the end of the gallery into the book room. This lamp is provided with three 25-watt frosted lamps and a rose-toned

Various Types of Equipment Employed in the Bed Room for Convenience, Comfort and Artistic Effect.

Simplicity Dominates the Lighting Equipment in Trophy Room.

silk shade. The base of this lamp is of marble and it rests upon a substantial marble pedestal. A portion of the shade of this lamp may be seen at the side of the hall clock at the far end of the gallery. The bulbs employed in the floor lamps illuminating the gallery are all provided with candelabra bases, these small bases being required because of the desire to keep the sockets of such size as to properly represent actual candles. As in the case of the various wall brackets, the individual floor lamps are provided with switches worked into the structure itself, in addition to circuit switches mounted in convenient places in the various archways about the gallery.

Personal Taste in Evidence in Rooms Devoted to Individual Use.

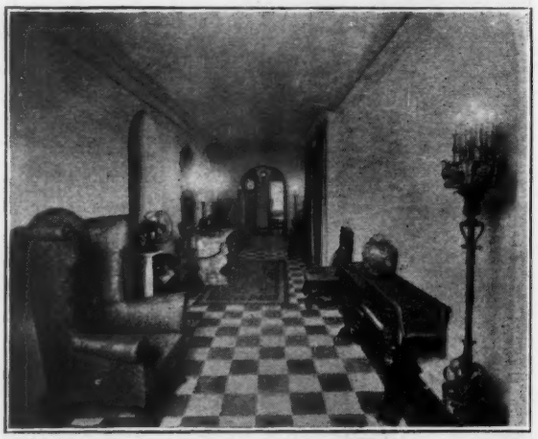
Individuality of taste has been displayed in the selection and arrangement of the lighting fixtures, as in the selection of other fittings and furnishings, in the rooms devoted to the more personal uses of the members of the family. Fittings and furnishings in the trophy room, used as a lounge or den by the man of the house, are extremely plain in design, but are entirely in keeping with the rest of the room and with what might be expected in a man's room. General lighting is supplied by a number of silver wall brackets with filed finish. Short old-ivory candle sockets support the frosted bulbs, and individual switches provide local control in addition to the circuit control by conveniently located wall switches. A table lamp, with an art glass shade and six individually-controlled "Fireside Glow" bulbs, rests on the table just back of and overhanging the couch arranged before the fireplace. This unit undoubtedly is the one most used as it provides a warm and comfortable light for reading in the luxurious and inviting restfulness of the homelike hearth.

As might be expected, a distinctly different tone is to be found in the room occupied by the lady of the house. Here are to be found many dainty fixtures with silk and colors representing the tastes and moods of the woman who selects them. There are finely worked bronze wall brackets with pendent crystals, old-ivory candle sockets and rose-like shades. There are table lamps with metal bases, table lamps with china bases, a bed lamp with a blue silk shade and dainty boudoir lamps with both metal and china bases. It is quite difficult for mere man to comprehend how it would be possible to make such a fitting selection of dainty equipment, much less to attempt to describe it. As may be seen from the illustration, candle sockets are employed in most of the fixtures. The bed lamp supported by a floor pedestal near the head of the bed, is provided with one 50-watt amber bulb. The dresser lamp, shown at the extreme right, is also provided with an amber bulb, and two 25-watt amber bulbs are used in the table lamp with the china base shown in the far corner of the room. Beyond the screen and through the draped doorway shown at the right is a small dressing room. This space is illuminated by three 2-lamp brackets similar to those in the larger room and by four other portable lamps. Two of these portable lamps rest on the ledge of a full-length mirror, the lamp bases being in the form of china dancing figures. A small stand lamp with a black china base rests on a taberet at the side of a lounge in the corner of the dressing room. Another lamp with a china base and silk shade rests on a small table just beyond the screen.

A much less elaborate treatment has been given to the remaining rooms in the apartment. One room fitted up for the daughter of the family, a girl of about nine, is provided with wall brackets and a ceiling fixture all in the form of flower baskets. Decorations of the room and the furnishings are all such as would appeal to a little girl, and the lighting fixtures are quite in harmony with their surroundings.

The boy of the family, who is still younger, has a room fitted much more plainly. The fixtures in this room are plain white simple wall brackets and a plain circular ceiling disc with a single frosted bulb. Four of the wall brackets with frosted bulbs are employed at the sides of the room.

A bedroom, evidently reserved for the use of a man, is fitted quite simply. One silk-shaded table lamp, supported on an Indian figure, rests on the dressing table and four simple gold-



Floor Lamps Are Artfully Employed in the Illumination of the Gallery.

finished bracket lamps with frosted bulbs are used on the side walls. The table lamp with a black marble base and hand-painted parchment shade rests at the head of the bed and a 3-lamp ceiling plate is installed to provide for general illumination.

Illumination and Fixtures for Department Stores

Character of Goods on Display and Type of Interior Finish Determine Quantity of Light Required—Modern Lamps and Glassware Permit of Results Not Obtainable With Early Equipment

By A. L. POWELL

Lighting Service Department, Edison Lamp Works, Harrison, N. J.

Without artificial lighting the modern large store would not be an economic possibility. Space is too valuable in the cities to so design a building that adequate daylight can penetrate a great distance from the street, so that the continuous use of lighting equipment is a necessity. The health and welfare of the clerks are to a degree dependent on the lighting system, and this factor must receive careful consideration. Bright illumination reduces the opportunity of the shoplifter.

Who would care to purchase an article in a room where it is not possible to examine it with ease? Lighting helps toward minimizing the return and exchange of goods. Then, there is the psychological effect of good lighting. If there are two stores handling the same grade of merchandise, one brilliantly illuminated, the other dull and unattractive, there is no question which one you would patronize. The advertising feature of lighting which compels attention has been recognized for a long while; hence, our whiteways, bright show windows and sparkling electric signs. If a store is well illuminated it will draw the crowd.

Good lighting puts the customer in a pleasant frame of mind, it makes sales work easier, and this in turn helps to keep clerks and employes cheerful and courteous.

The value of proper illumination is so self-evident that there is no necessity to dwell at length on its advantages. It is not intended to tell why a store should be well illuminated for this subject has been presented so many times that it can be assumed that everyone is convinced. There are many methods of illuminating an interior, all of which can be used for a store. Some are especially well suited while others are not so well adapted.

The store should not be under-illuminated, thus presenting a gloomy appearance; on the other hand, in many cases the displays may be well

Night View on Main Floor of Store Lighted With One 500-Watt Lamp per 20 Ft. Bay Using Opalescent Inclosing Globes.

Silk and Chiffon Section Lighted With 500-Watt "Daylight" Lamps in Semi-Indirect Fixtures.

lighted from the standpoint of enough light actually reaching them, and yet the store may be disagreeable and uninviting. To make the store pleasant lamps must be properly placed and so shielded that they are not glaring. The lighting equipment must be artistic and well arranged so that it will produce a pleasing appearance without drawing one's attention away from the merchandise.

In general, store managers are a most progressive group of men in adopting the latest and best form of illumination, and every development is tried by the merchant to see whether or not conditions can be improved. As a result of this very progressiveness, as one passed through the retail section of a city only a few years ago, he saw a different type of illumination in almost every store. Then the tungsten lamp appeared on the market and was tried out in a few representative stores. Its success was instantaneous, and now it is almost without exception the univeral illuminant. To the casual observer this rapid superseding of all other forms of illuminants is little short of marvelous, but when we stop to consider the inherent advantages of this lamp its success is to be expected.

Desirable Intensity of Illumination for Various Departments.

By intensity of light is meant the amount of light falling on the object viewed. We see things by the light reflected from them. Obviously, a piece of black cloth will reflect less light than some white furniture; hence, for the eye to receive as much light from the one as from the other considerably more light must fall on the dark goods. It is quite evident that there is a certain desirable range of intensities of illumination to properly display different kinds of goods. A book department will demand more light than a white-goods display; a shoe shop requires more light than furniture, etc. Where goods of different character are on display in the same department it is necessary to supply sufficient light for those most difficult to illuminate. Tables have been worked out by competent engineers for the convenience of those who care to use them, giving the desirable quantity of light for the different departments, a typical table being presented herewith.

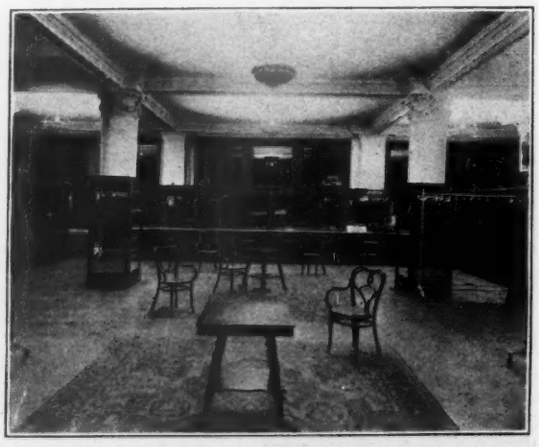
The large number of sizes of standard tungsten lamps permits them to fit in particularly well with this situation. Suppose a certain type of fixture is adopted for an entire floor (this is, of course, a desirable condition) where the maximum light is needed, say, in the fur department. Then 200-watt type C lamps might be used. If the notions department were on the same floor 100-watt type C lamps on the same spacing would give sufficient light, while in the furniture department lamps of 75-watt size would serve. This assumes, of course, that the store is so arranged that the variation in light does not produce an inartistic effect.

Color of Light and Diffusion in Relation to Store Illumination.

The demands of the department store as to color of light are so complex and varied that a complete discussion of them here is not possible in the space available. While "Daylight" lamps are used in many instances for general illumination, and offer many advantages, the most generally accepted practice is to use the warm unmodified light of the ordinary type C lamp for this purpose. At what might be called strategic points—ribbon counters, triplicate mirrors in the clothing department, in the piece-goods department, etc.—are located accurate type of color identification units. This arrangement provides a pleasing appearance in the store proper, per-

TABLE SHOWING INTENSITY OF ILLUMINATION DESIRABLE IN VARIOUS DEPARTMENTS OF A STORE.

Department.	Foot-Candles.
Art (light on exhibits)	5 to 10
Book	4 to 6
China	3 to 4
Cigar	5 to 8
Clothing	5 to 9
Cloak and suit	5 to 9
Confectionery	4 to 7
Drug	4 to 6
Dry goods	5 to 8
Florist	4 to 5
Furniture	3 to 4
Fur	7 to 9
Groceries	4 to 6
Haberdashery	6 to 9
Hardware	4 to 7
Hat (men's)	5 to 8
Jewelry	6 to 9
Millinery	5 to 7
Music	4 to 6
Notions	4 to 7
Piano	3 to 4
Rug racks	8 to 10
Shoe	5 to 8
Stationery	4 to 6
Wall paper	4 to 5



Clothing Department Where 750-Watt Type C Lamps Are Used With Indirect Fixtures.

mits accuracy in selection of material resulting in satisfied customers, and causes a remarkable saving of time which would otherwise be lost in carrying merchandise to a window or doorway for inspection.

With the present-day brilliant light sources diffusion is of especial importance. Diffusion can be secured by increasing the apparent size of the light source, either by the use of depolished reflecting surfaces or translucent globes or shades. Diffusion eliminates sharp shadows as well as excessive intrinsic brilliancy of the source, and we speak of it in opposition to glare. Glare has been aptly described as light out of place. It reduces the ability to see, fatigues the eyes and, if severe, will undoubtedly have a permanent effect on the visual mechanism. It is, therefore, a thing to be avoided.

Arrangement and Systems of Lighting Suitable to Store Application.

In the early days when only inefficient lamps without effective reflectors were available it was sometimes necessary to place lighting units close to the counter in order to obtain sufficient illumination without undue expense. Needless to say, this scheme was not productive of attractive stores. Now general lighting is universally used. Lamps are arranged symmetrically with regard to the bays or pillars, and the whole floor is uniformly lighted. It is not necessary to take into account the position of the counters when spacing the lamps, for a sufficiently high intensity is provided everywhere for one to carefully examine the goods on display. If the rules for spacing outlets are observed there need be no fear of producing objectionable shadows in any part of the building.

There are three generally recognized methods of applying light, known as the direct, semi-direct, and totally indirect methods. All of these are applicable to the store. With direct lighting the lamp is fitted with an open-mouth reflector which directs most of the light downward, or it is placed within an inclosing globe which does not materially affect the distribution, yet diffuses the light. In the semi-indirect system a glass bowl or dish is placed beneath the lamp, transmitting some of the light, but directing most of it to the ceiling, from which it is reflected. A totally indirect unit is opaque and directs all the light upward to the ceiling and walk from which it is again reflected down to the working plane below.

Open Bowl-Shaped Opalescent Glass Reflectors Used Under Low Ceiling.

"Daylight" Lamps in Individual Reflectors Employed to Illuminate Art Exhibit.

As stated before, the eye should not be exposed to the unshielded filament of the modern lamp, as this is of too great a brilliancy, producing discomfort and reducing the ability to see. It is good practice, therefore, to equip the light source with some sort of a diffusing device or to use a reflector. A reflector, besides reducing the brilliancy of a source, has a further advantage in redirecting the light. The necessity for the redirection of light is quite evident when we realize that the maximum candlepower of most illuminants is in the horizontal direction, and with lamps hung pendant without reflectors, would be directed against the wall. The reflector placed above or around the lamp catches the light rays emitted toward the sides and upward and redirects them downward. Thus we get the light on the counter or desk much more efficiently than if the light rays were allowed to reach the wall and then be reflected, for the surface of the reflector is a much better reflecting device than the average wall covering.

There are a great many varieties of reflecting equipment from which to make a selection, and it is obviously impossible to analyze each type, so merely the various classes will be discussed with particular attention to their suitability for the department store.

Types of Direct Lighting Equipment and Discussion of Details.

Prismatic-glass bowl reflectors.—If these are properly designed they are extremely efficient in directing the light in any predetermined manner. The maximum amount of light is sent to the counters, although some is transmitted upward and to the side. Since this light forms but a small percentage of the output the effect of dark colored walls and ceilings is minimized with prismatic units. Therefore, where these conditions exist this particular type of reflector is of great service. Again, where the expense of lighting must be kept at an absolute minimum, the high utilization of the prismatic equipment makes it quite suitable. This type of unit had a wide use a few years ago, but is now largely replaced with somewhat more decorative equipment.

Opalescent-glass deep-bowl reflectors.—These are made in a wide variety of designs of heavy,

medium and light-density glass. The heavy-density units direct the light quite strongly into the lower hemisphere, while the light-density equipment directs a much smaller amount, transmitting a large part through the glass upward and to the side. The variation in efficiency between individual makes of any one glass, say light density, is very slight, and a reflector should be chosen whose design or decoration seems most suited. The highest utilization is obtained with heavy-density glass, while the light-density, transmitting more light to the ceiling and side walls, makes the store appear brighter. This is thought by many to be a desirable condition.

With any type of open-mouth reflector, prismatic or opalescent, the exposed portion of the lamp should be of a diffusing character. The bowl-enameled type C lamp falls in this category.

The shallow-bowl or flat opal reflector is sometimes employed for store lighting. This practice has little to recommend it, for a large portion of the lamp is visible and a glaring installation is very likely to result.

Opalescent inclosing globes.—If the proper glass is chosen these conceal the light source from view and diffuse the light so that the entire surface of the ball is equally bright. This should, of course, be done with minimum absorption. Individual makes and varieties of glass are quite different in this respect, and in choosing equipment carefully specifications of diffusion and loss of light should be adhered to. A great variety of shapes and designs are standard.

Spherical inclosing globes do not materially change the distribution of light from that of the lamp itself, as light is sent almost equally in all directions. This is not so serious as it might appear at first thought, for the light which strikes the light colored ceiling is largely reflected downward; that going to the side is useful in illuminating vertical surfaces and giving an appear-

much more difficult to manufacture.

Flattened or shallow opal-glass inclosing globes, which tend to send the maximum light up and down rather than to the sides, have recently been placed on the market. These naturally have this feature of more efficient lighting in their favor and should have a wide application.

It is impractical to look at the question of lighting the store as merely a problem of supplying a certain predetermined amount of light on the counters. If this were the object the most economical method would be to locate a series of projectors close to the ceiling and send strong beams of light downward, but it is obvious that this scheme would make the store appear very unattractive, and shadows would be strong and harsh. Instead of having one plane such as the counter to illuminate the whole interior of the store should be lighted, and the flux of light should be spread in all directions. From this it is evident that while from a standpoint of efficiency of lighting the counters the inclosing globe, or semi-indirect unit, is not to be compared with other units, yet it is very often most suitable to give the soft flood of light in all directions necessary for the best results.

Prismatic inclosing globes.—These combine the complete shielding of the lamp with the directional effect of the prisms. The efficiency of light utilization of these is the highest of any of the inclosing globes, but the glassware is somewhat more expensive than the opalescent, as it is much more diffcult to manufacture.

Semi-inclosing units.—A number of patented designs of reflectors fall in this class which, in general, consist of a lower diffusing member and an upper reflecting device. The upper reflector is opaque in certain types and translucent in others. As a class they give the same order of diffusion as the inclosing globe with more directional effect. The same precautions as to adequate size must be observed. The open units are susceptible to dust collection, and those with an opaque top are likely to cast a dense objectionable shadow on the ceiling if care is not taken to insure proper spacing and hanging height. Semi-inclosing units are obviously of particular service when dark surroundings prevail.

Various Types of Equipment for Semi-indirect Lighting.

Opalescent bowls.—The standard shapes, sizes and decorations of these are almost without number, many being tinted and otherwise decorated. Some progressive stores have a design made especially for themselves with a monogram or special feature etched or pressed into the structure of the dish. For the indirect systems the ceiling and walls must be light in color if the illumination is to be effective. Since the ceiling is the most brightly illuminated part of the structure, and considerable light also is thrown towards the side walls, the room appears bright—a desirable condition. Of course, for equal illumination on the counters somewhat more power must be used than is required for direct lighting.

Inclosing semi-indirect.—While any type of lighting unit must be regularly cleaned if it is to continue effective, inverted bowls are inherently most susceptible to the collection of dust and other foreign materials. This makes the depreciation of light somewhat more rapid and requires a shorter period between cleanings. To overcome this difficulty there has been recently introduced a one-piece glass semi-indirect inclosing unit. The bottom and sides are enameled white, giving the necessary direction and diffusive effect and the upper half is of clear glass. This is designed to have minimum absorption and is so sloped as to reduce the accumulation of dust as much as possible. The light-emitting properties and the quality of illumination produced are identical with the opalescent bowls discussed above. It is apparent that this type of fixture has qualities which strongly recommend it from an operating standpoint.

Metal and glass semi-indirect.—A form of equipment which has a wide application consists of an inverted porcelain enameled reflector with an opening in the bottom covered by a diffusing glass plate. With the proper curvature of the reflector, and the plate in the correct relation to it, a widespread distribution of light is secured and the exterior of the opaque reflector is slightly illuminated. These devices give a soft pleasing quality of illumination and are susceptible of a wide variety of treatment with various ornamental accessories such as silk, cretonne and parchment shades, cast-metal ornaments and silk diffusing screens.

(To be continued.)

Marked Improvement Is Effected by the Change From Glaring, Exposed Light Sources in the View on the Left, to Fixtures Combining Efficient Lighting and Comfort to the Eye, in the View of the Same Room on the Right.

Lighting for Comfort in Homes and Public Places

Use of Diffusing Glassware Gives Relief from Inconvenience Caused by Glare from Unprotected Lamps, and at the Same Time May Be Selected with View to Harmonious Decorative Qualities

By H. T. SPAULDING

Engineering Department, National Lamp Works of General Electric Co.

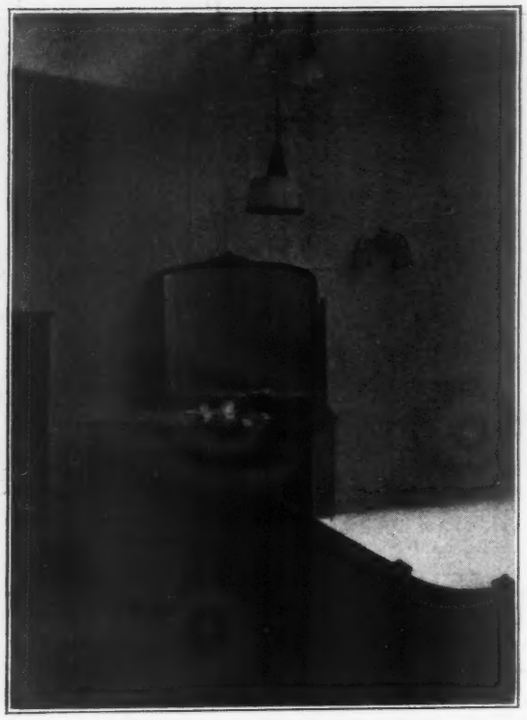
Everyone who has had experience in industrial illumination has probably at one time or another listened to complaints on the part of workmen that lighting units mounted at a considerable height above the work did not give as much light as the drop-cord lighting which they replaced, even though the illumination on the work was actually higher under the general lighting system. The reason, of course, is that the average individual gages the illumination, to a large extent, by the brightness of the source itself.

To illustrate further, if you yourself were asked your opinion of the lighting of a room, on what would you base your decision? It is almost certain that your first action would be to glance up at the lighting units and that your reply would depend to a great extent upon the brightness of the lighting unit rather than upon your observations of the illumination itself. This psychological tendency may possibly be the reason for the existence of many forms and the wide application of lighting units which are actually so bright as to be objectionable or even harmful. The brighter the unit appears, the more light many individuals believe it will produce, and the easier it may be to sell.

If we carry the above reasoning to the extreme the logical lighting unit would, of course, be a clear unshielded lamp. It should no longer be necessary to discuss the objectionable features of such practice and yet we every day observe instances where a lack of knowledge or a misjudged economy results in installations which are actually a menace to the vision of those who must necessarily spend considerable time under such unfavorable lighting.

Somewhat less dangerous but fully as objectionable, due to the increased frequency of their occurrence, are those installations in which an unsuccessful attempt has been made to reduce the brightness of the light source. I refer to the use of lighting glassware which is too small for the quantity of light given out or is of too light a density, or both, and to the usually inadequate protection afforded when only frosting or etching on the bulb of the lamp is used to reduce the brightness. The former occurs principally in commercial lighting, offices, stores, etc., and the latter usually in the lighting of public or semi-public buildings, and the home. The very nature of these locations indicates that the lighting will be in use for considerable periods of time and should consequently be so designed to provide a maximum degree of comfort.

The discomfort which may be experienced from these installations is dependent both upon the brightness of the light source and the volume of light coming from it, and also upon the contrast between the brightness of the unit and the brightness of the surroundings. It is not the intention, however, to discuss volume of light, values of allowable brightness or contrast, but rather to make a few suggestions which will perhaps assist in the avoidance of some of the objectionable features in present or future installations.



Lighting Equipment in Bed Room of a Home.

Too often bare lamps, or glassware which does not diffuse the light properly, are found on fixtures such as are shown above, properly equipped.

It is possible to obtain the same amount of light from a large area of low brightness as from a small source having a brightness so high as to be very objectionable. It might further be added that the low brightness unit would also be preferable in that shadows would be softened and reflected images of the source would be less trying on the eyes. A larger light-giving area is, however, of greater advantage only if it is comparatively uniform in brightness. A lightly etched globe of large size, for instance, having a small area of extremely high brightness would be almost as bad as a globe of smaller size. A certain degree of uniformity is often desirable also from the standpoint of appearance.

Importance of Selection of Appropriate Diffusing Medium.

In the selection, therefore, of diffusing mediums, globes, bowls or whatever they may be, there are several items to be borne in mind. First, the medium employed should have such good diffusing properties that, with the lamp back of it, there will be either no apparent bright spot of light, or the spot will not be materially brighter than the remainder of the unit. Second, the size of the unit should be such that, when it is equipped with the lamp with which it is to be employed, it may be viewed for some time against the background with which it will be used without discomfort or strain due to brightness or glare. Third, information should be obtained as to the efficiency of the unit under the given conditions, as it is, of course, very easy to obtain the desired low brightness by a corresponding sacrifice in the amount of light given out.

The above points to be observed in the selection of commercial lighting equipment apply also to certain units used for public building and residence lighting. There are other types of fixtures now commonly used in the lighting of homes, theaters, churches, auditoriums, etc., in which no provision for diffusion is made and which depend upon the standard frosting of the lamps for reducing brilliancy. In the larger interiors these frosted lamps are usually studded on large fixtures or mounted on wall brackets. In residence application they are generally employed on so-called candelabra or candle fixtures.

The lamps used with both of the above types of fixtures are usually of low wattage and, consequently, the brightness is not excessive and would not be particularly objectionable from the standpoint of glare were the surroundings, or background against which they are seen, of a fair order of brightness. It is, however, true that the finish of rooms of this character often is dark or of a medium tone. In an endeavor to create a comfortable atmosphere bright ceilings are avoided and light side walls are the exception. Consequently, the contrast is such that even units of a comparative low brightness produce discomfort.

Unshielded Lamps in Public Auditoriums Disturb and Distress Patrons.

There are motion picture theaters where unshielded lamps on side-wall brackets automatically arrest the attention of the patron and interfere with his view of the picture. Ceiling fixtures of a similar type hung too low cause discomfort to those occupying balcony seats. There are churches in which the congregation experiences difficulty in remaining awake during the service, not due to the preaching, but to glaring exposed light sources constantly within their range of vision. There are homes in which the pleasure of many an evening has been marred by the discomfort caused by unshielded lamps upon the side walls or on low hung ceiling fixtures; where the cozy home-like atmosphere produced by well regulated contrast and warm tones can be accentuated by the judicious use of diffusing mediums.

It is possible to eliminate much of the unpleasantness produced by glaring lights. In new installations the fixtures should be so chosen that exposed lamps or too bright spots of light are avoided. There are innumerable fixtures which have these satisfactory characteristics and still have all the advantages of efficient light distribution, and which can be adapted to harmonize with any desired architectural or color treatment. In the selection of such fixtures it is only necessary to add to the three requirements listed above for commercial lighting, a fourth, that the fixture be appropriate in design and treatment for the location in which it is to be used. In fact, the third rule might possibly be given much less weight as it is often desirable to sacrifice a portion of the efficiency for appearance.

Lighting in many existing rooms can be materially improved at a moderate expense by the use of decorative shades of glass or other diffusing material. Such improvement is not confined alone to the reduction of uncomfortable brightness. The shades can be so chosen as to give a more desirable distribution of light, a more harmonious color effect and a distinctive period or decorative treatment raising the tone of the general decorations. In the home in particular there

should be no points of extreme brightness. While the lighting should not necessarily be uniform, the high lights should be warm in tone and not too brilliant. There should be an atmosphere which can be created only by soft lighting, and

Unshielded Lamps Producing Disagreeable Glare Against Dark Background.

hardly ever by unshaded lamps. A little careful thought, the studied selection of diffusing glassware, and you will be surprised at the wonders which may be accomplished in increasing the comfort and satisfaction derived from lighting.

ECONOMY OF EFFICIENT STREET ILLUMINATION IN CITIES.

Instances Are Cited Where Some Ancient Types of Street Lamps Are Now Maintained at Costs in Excess of Modern Installations.

By C. D. Salfield,

Chairman Street Lighting Committee, Haight and Ashbury Improvement Association.

There is hardly anything that adds so much to the desirability of a residential thoroughfare or a district of homes as well-lighted streets, and nothing detracts so much from an otherwise high-class residence district as poor street lighting. This is particularly well illustrated in the Haight and Ashbury districts in San Francisco, the streets of which are, with two notable exceptions, very poorly lighted with out-of-date contrivances.

The exceptions are Buena Vista avenue, on the eastern slope of Buena Vista Park, and Ashbury Terrace. The first mentioned is probably the best lighted street in San Francisco. The superior lighting conditions here were brought about by the progressive, far-sighted, wide-awake, public-spirited property owners along its line and in the vicinity. They insisted upon the removal of the unsightly wooden poles, while the overhead wires were placed in conduits underground. Beautiful electroliers have replaced the old-time, unsightly lamp posts.

The property owners did nearly all of this, it should be noted, at their own expense, the city paying, as is customary, for the lighting. Not only were these beautiful electroliers set on the property side of this magnificent avenue, but they were placed on the Buena Vista Park side as well.

Of Ashbury Terrace, the same may be said. Under the leadership of former Mayor P. H. McCarthy, a resident of the district and a member of this association, a great improvement was effected in the lighting of this district. The single standard electroliers were installed and they are in full harmony with the beautiful homes, lawns and gardens with which the neighborhood abounds. The electroliers are not quite so elaborate as those on Buena Vista avenue, but are very efficient and less expensive to operate. It is the opinion of experts in street lighting that this kind of lamp post ought to be the standard for all of the Haight and Ashbury district and for all other residential sections.

In contradistinction to the foregoing well-lighted streets, Fell street, west of Baker, which was at one time considered the best lighted street in San Francisco, and of which the residents and property owners along its line to the entrance of Golden Gate Park felt justly proud, is now one of the poorest lighted streets in the city.

It started out well, soon after the closing of the Exposition, with 3-globed double-light Welsbach gasoliers of an exceptionally pleasing and artistic design, but had to submit at the very outset to a spirit of jealousy and a streak of false economy, the top globe being removed soon after the gasoliers had been set.

Next, on account of our ill-advised municipal administration, 30 odd thousand dollars were cut from the street lighting fund in the budget, another piece of false economy and a political *faux pas,* another globe was removed, causing the gasoliers to look lopsided, so that as it was this otherwise magnificent thoroughfare, and by all odds the most frequented automobile drive in the city, had a very dilapidated appearance both by day and by night.

Page street and the streets adjacent thereto and crossing it are fairly well lighted by the old-fashioned Welsbach gas lamps, but to see the lamp lighter trot along these streets every evening in the gloaming for about an hour to finish his job of lighting with a torch reminds the few old citizens of the district of the days of 1849, or 70 years ago, when electric lights were unknown.

The cost of installation of up-to-date street lights is insignificant when one considers the benefits derived therefrom, and when compared to the cost of other street improvements, such as sewers, curbs, paving and sidewalks, any one of these having cost from 50 to 500% more than what it would cost to put all of the wires in conduits underground, remove all of the ugly poles and provide artistic, up-to-date electroliers.

It is amazing, to say the least, that the property owners and residents of San Francisco, along its most beautiful streets, well built up with pretty and expensive homes and all street work completed, will continue to put up with street lighting of a sort that residents of small country towns would be ashamed of. It is furthermore amazing to think that people will pay from $2000 to $5000 and more for a building lot and spend from $5000 to $20,000 for a home and then be satisfied, seemingly, with rough, ungainly poles 40 ft. in height stuck into the sidewalk, four or more to the block, with a glimmering arc light near the top of one of the poles, when for less than the one-hundredth part of the cost of a bare lot they could have decent, up-to-date illumination.

Types of Circuits Employed in Street Lighting—Part I.

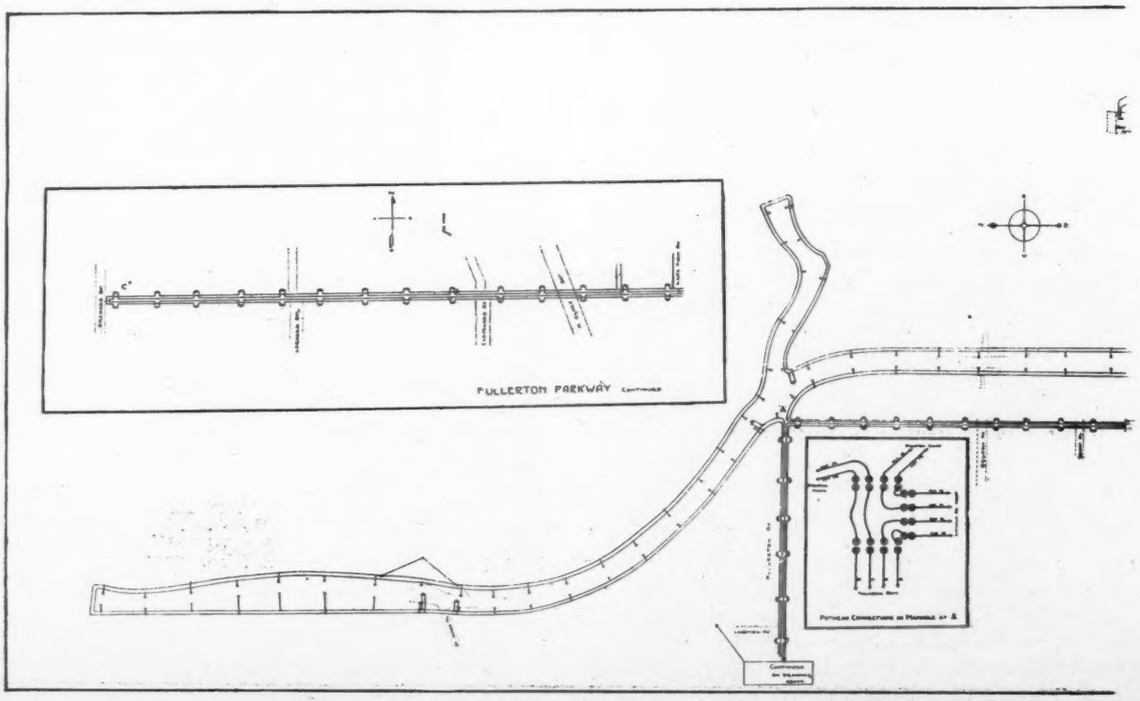
Multiple and Series Circuits, With a Number of Intermediate Combinations, Utilized for Street Lighting Purposes — Group System Combines Many Important Advantages of Other Systems

By C. H. SHEPHERD
Consulting Engineer, Chicago.

In the July 9, 1921, issue of the ELECTRICAL REVIEW a number of types of street lighting standards and units were shown, and it is the object of this article to take up the subject of street lighting circuits in such a manner that their purpose may be made clear. Street lighting circuits may be classified as multiple constant-potential, straight series constant-current a-c. or d-c. arc or incandescent, series compensator constant-current, series multiple constant-current, series multiple constant-potential, and group or series-series circuits. Such circuits are capable of many variations in form and character, according to local conditions and requirements, but the above named classes furnish a general classification which may be taken as standard in the present development of the art.

Present practice in the United States leans very strongly towards the series system of street lighting control, but in many instances both series and multiple street lighting circuits will be found in the same community although the series circuit is more easily controlled and more efficient from an operating standpoint than the multiple circuit. However, the possibilities of multiple street lighting are far from being exhausted. There is no doubt but that in certain cases great economies could be effected by bridging street lighting leads across existing low-tension multiple circuits already used for commercial power and lighting distribution. In cases where it is necessary to light the streets surrounding a given block which is supplied with existing multiple service it is only necessary to run low-tension cables or wires from the transformer secondaries to the lamps which may be installed in suitable locations on either overhead or underground circuits. Assuming an elaboration of such a system the lamps themselves may be controlled by means of time switches, cascade control, pilot wire control, or by any one or a combination of relay devices which are now commercially manufactured.

Where labor costs are low it is often found to be economical to turn multiple units on and off by means of a patrolman. A notable installation of this character and of extremely large size has been operating for a number of years in New York City and is efficient, reliable and successful. The flexibility of the multiple street lighting



North End of Combination Series Circuit Showing Compensators, Series Multiple Transformers and Disconnecting Pothead Installation.

circuit is such that a large variation may be obtained in the number and sizes of lamps which may be used on any given circuit. The low cost of low-tension wiring or cable, safety and reliability, the ease of adding more lamps or of cutting in different sized circuits, and the low cost and simplicity of fixtures and various auxiliary devices all are decidedly advantageous in the use of such circuits.

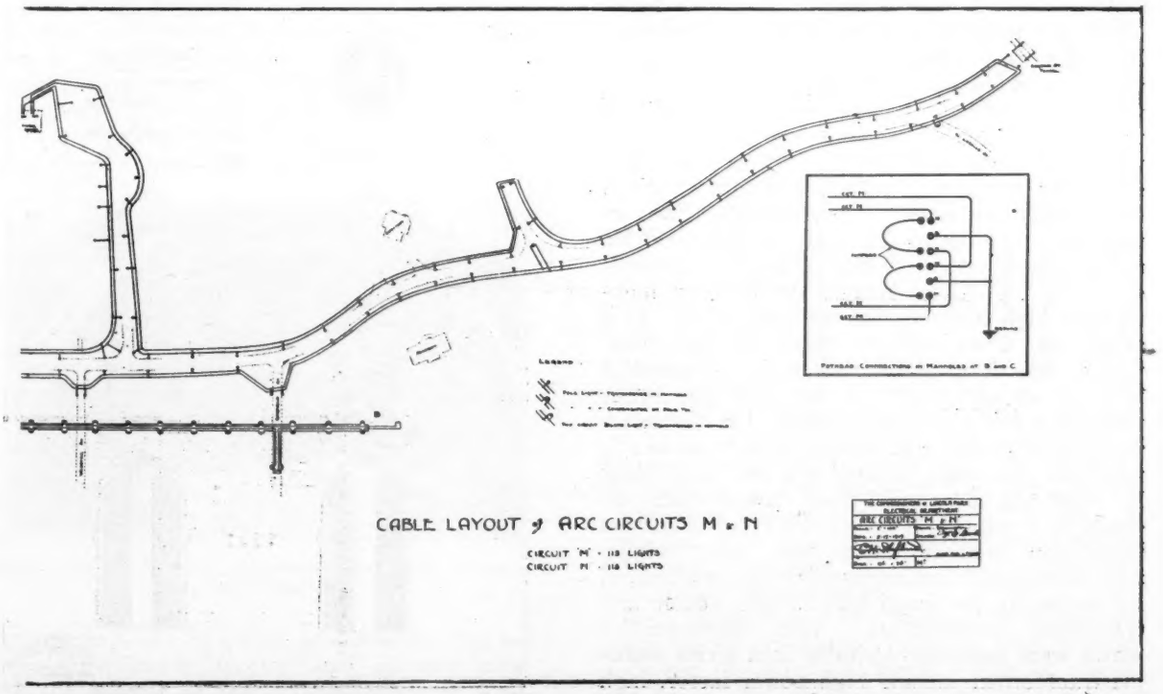
However, aside from the general system voltage control, it is rather difficult without the addition of complicated regulating to assure constant voltage at the lamps. In case of system voltage fluctuations it is apparent that a possibility exists of burning out a large number of lamps. Another disadvantage inherent in the multiple circuit is the necessity for graduating the copper sizes to conform with load and distance, which in the case of the individual special multiple circuit may lead to excessive copper capacity. It is apparent therefore that the chief advantage of the multiple circuit consists of the possibility of adding lamps or lamp loops to already existing low-tension multiple circuits. Another operating disadvantage which may be rightfully ascribed to the multiple circuit is the fact that the large size type C multiple lamp has a considerably lower efficiency than the series lamp which will emit an equivalent number of lumens. Average efficiency figures may be stated as 0.65 watts per cp. for the multiple lamp and 0.55 watts per cp. for the series lamp, based on the mean horizontal values in each case.

Direct Current Employed With Early Constant-Current Series Systems.

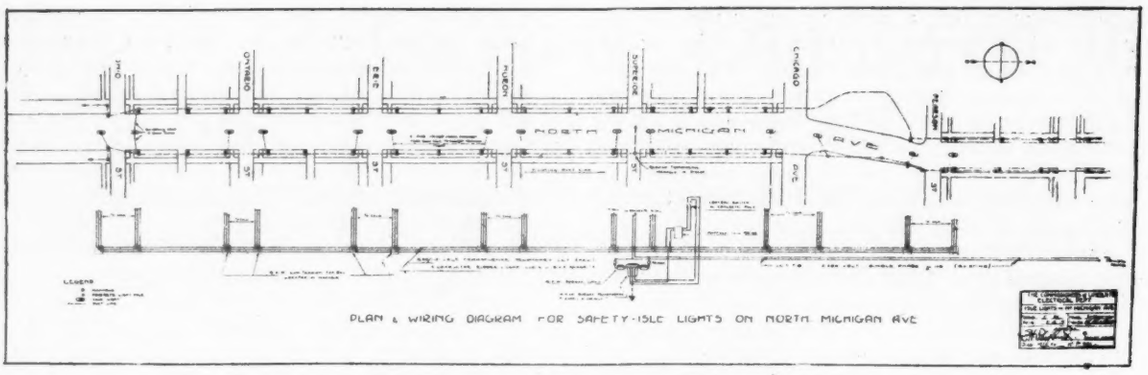
The earliest form of straight series constant-current arc circuit consisted of a number of d-c. open arc lamps connected in series and supplied with energy by means of a high-voltage generator. The development of the multiple distribution system for lighting and power led to the development of the multiple arc lamp, the success of which was extremely doubtful due to the inherent characteristics of the lamps themselves. With the constantly increasing use of alternating current inclosed series a-c. arc lamps were placed in commercial operation and were followed by the development of the series incandescent system. Inasmuch as the series incandescent lamp has no moving parts and consequently no possibility of employing self-contained cutouts of a mechanical nature, such as were used with the series arc lamp, it became necessary to construct suitable continuity devices for use with incandescent lamps, resulting in the production of the film series cutout. Under proper conditions the film cutout may be considered as a successfully operating device, and due to its low cost and simplicity of installation, operation and maintenance it possesses many inherent advantages. However, under unfavorable atmospheric conditions the reliability of the film cutout is extremely doubtful, due to the accumulation of moisture, corrosion of metallic parts and the interference of insects.

The most modern and efficient development of the d-c. circuit is that of the magnetite arc lamp. Circuits of this nature are installed either aerial or underground and supplied with power by means of high-tension mercury arc rectifiers. In several notable installations the cost of operation and maintenance of the magnetite system has been found to compare favorably with that of the series incandescent system.

In order to offset the effect of vibration and to allow the operation of incandescent lamp filaments at higher temperatures it became necessary to develop the high-current, high-efficiency incandescent lamp. In order to eliminate to a certain extent the line losses attendant upon the use of high circuit current and the consequent inductive interference it is obvious that some de-



South End of Combination Series Circuit Showing Compensators, Series Multiple Transformers and Disconnecting Pothead Installation.



Multiple Safety-Island Lighting Circuit With Manual Control.

vice was needed to step up the line current to a suitable value for the operation of such lamps. The auto-transformer or compensator, which was the logical equipment for such service, was constructed and installed in many instances and from an operating standpoint is successful, embodying as it does, low core losses and inherent regulating characteristics. However, the fact that the coils and core in such installations are usually exposed to the action of the atmosphere and the accumulation of dirt and insects naturally proved a serious obstacle in the use of such equipment. This was aggravated by the fact that it became necessary to run high-tension leads to the lamp terminals, which of course is costly and not conducive to safety. The series compensator circuit may be said to embody the necessary elements of high efficiency and high power-factor which are desirable in series circuit operation, and also inherent regulating characteristics which are conducive to continuity of service and lower cost of operation.

A great drawback to the series circuit is its lack of flexibility. On many street lighting systems it is necessary to operate safety island lights and various low-tension signal and marker lights which are inherently of multiple characteristics. In order to properly accomplish this purpose, and to provide safety from accident and independence of operation, it was considered desirable to develop a 2-coil transformer, the primary of which was connected in series with the line. The secondary carries the load supplied by the various small lights mentioned. The successful construction and operation of this type of equipment led to the idea of the safety coil, or 2-coil transformer which supplies current to the modern, high-current, high-efficiency incandescent lamp. As a result the series multiple street lighting transformer was developed. This device consisted at first of an adaptation of the pole-type series multiple safety island transformer, but the necessity and advisability of installing such devices in manholes eventually resulted in a well-built, highly insulated, compound-filled transformer inclosed in a watertight metal case from which the leads were brought out in brass sleeve wiping nipples to which underground cable was spliced by means of the usual tape, sleeve, solder and compound construction. The characteristics which were naturally desirable in a series multiple transformer include high power-factor, high efficiency, adequate insulation between primary and secondary coils and also to ground, besides various inherent regulating characteristics the flexibility of which is made use of to produce a straight-line current curve. From its inception the series multiple transformer system was an unqualified success inasmuch as it eliminated the necessity for running high-tension leads to pole tops, provided independence of illuminating units, secured safety to the public in case of accident to any lighting standard, and embodied high power-factor, efficiency, and also the automatic non-movable regulating features which were secured by means of auto-transformers or street lighting compensators. The safety provided by the series multiple transformer is due to a large extent to the high insulation between coils and also to the fact that the secondary circuit has low insulating requirements, thereby insuring a breakdown to ground in the case of failure of insulation between primary and secondary. The series multiple constant-current transformer circuit of

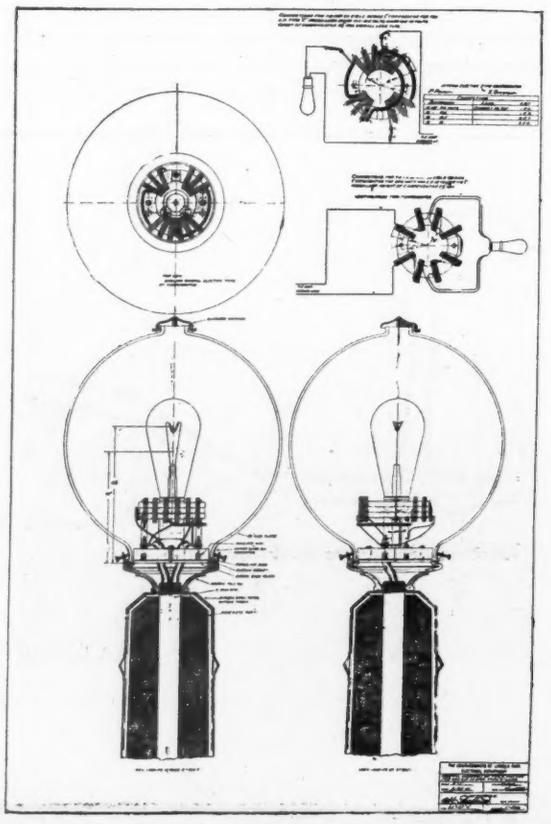


Diagram Showing Lines Changed to Serve Type C Lamps With Compensators.

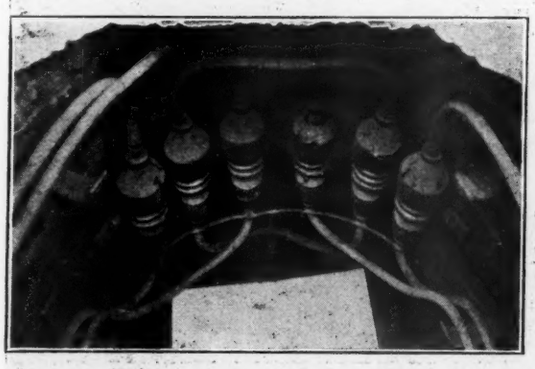
the nonregulating type in which current regulation is secured by means of an impedance regulator provides an easy and convenient solution of many otherwise complicated street lighting circuit problems.

With the development of the constant-current series multiple transformer circuit it became apparent that by the addition of certain inherent regulating features, which could by proper design be embodied in the transformer characteristic, it was possible and advisable to design and operate the series multiple constant-potential circuit, thereby eliminating all moving parts and providing ample safety and regulation for the lamps.

Line Current Limited by Independent Devices or Automatic Regulation.

Two schemes for limiting the line current have persisted, one requiring an independent regulating device and the other incorporating in each unit its own regulating feature. In speaking of a unit it may be called nonregulating or self-regulating, depending upon its intended characteristic. The series multiple, constant-potential circuit is necessarily of the self-regulating type. the power-factor being much higher than that obtained by other schemes, and the elimination of moving parts being accomplished. The difficulty of manufacturing lamps having exact characteristics made it necessary to design and construct transformers the current ratios of which were nearly perfect between loads of 80 and 110% of normal, not over 0.2% current variation being allowed on either side of normal.

In this manner the series multiple transformer was developed to a high degree of accuracy, since such transformers supply proper protection against power surges and when properly used tend to prevent the occurence of resonance. They suppress harmonics and supply proper protection to the lamps in any given circuit in case a number of burnouts should occur. In the latter case it is obvious that under constant potential the burnout of a lamp or lamps on any given circuit would tend to increase the potential and consequently the current flowing through the lamps remaining on the circuit unless means was provided to insert a compensating impedance in



Disconnecting Pothead Installation in Loop Terminal Manhole.

the primary. By means of proper design this has been satisfactorily accomplished, thereby insuring the success of the constant-potential series multiple circuit which instead of being controlled by means of an impedance regulator is fed by a

Splicing Armored Cable to Series Multiple Transformers in the Field.

line transformer provided with suitable taps to supply the exact voltage required across the terminals of the series circuit, the current being maintained at a constant value as above outlined.

Experience in the use of various types of circuits in the natural course of events led to the desire for greater economies, not only in the original cost of any given installation, but also in the cost of operation and maintenance. Later developments have consequently followed the experience obtained on the different circuits above mentioned with the production of the group or series-series system. In brief, this system consists of a number of transformers whose primaries are in series on the line, with each individual transformer secondary supplying power to a small group series system usually comprising all the street lamps in one or two blocks. The number of lamps supplied from one transformer secondary was originally intended to run from 19 to 31, thus giving a secondary series circuit with an impressed voltage of not more than 600. In the case of systems using the 100-cp., 6.6-ampere straight series lamp a 2-kw. group transformer is usually found to be sufficient for any one group circuit. In the original design of this system the transformer primaries are connected in series on a 5000-volt circuit consisting of lead-covered, jute-protected, steel-armored cable.

In examining the advantages of the group system it is evident that safety to the public is greatly increased over any high-tension system, inasmuch as at no point will the pressure to ground exceed 300 volts; the outage due to the failure of any group circuit involves only the lamps of this individual group, or if properly connected only 50% of such lamps; the factor of safety of a group circuit cable is very high; the efficiency of operation is high owing to the fact that the transformer efficiency is approximately 96%; a restricted area is covered by the high tension cable, and if properly laid out such a system may be installed economically.

It is obvious, however, that on the individual group circuit film cutouts must be used in order to protect the individual lamps. This, of course, introduces the disadvantage of the use of auxiliary devices.

(To Be Continued.)

Developments in Electric Sign Lighting Practice

Lamps Increased in Capacity from 10 to 150 Watts for Utilization in Signs—Great Brilliancy Obtained by Proper Arrangement of Filament — Low-Wattage Lamps Suitable in Many Places

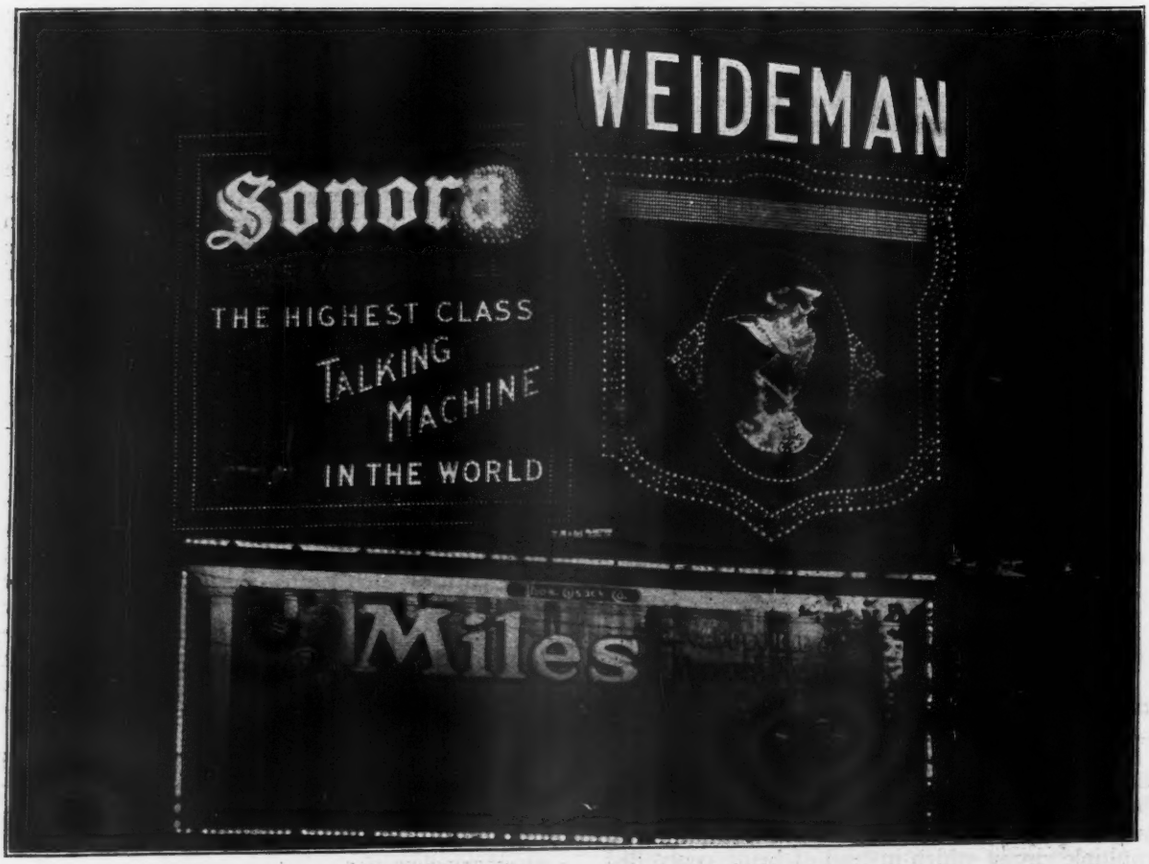
By W. E. UNDERWOOD

It is one of the axioms of the advertising profession that the time to advertise is when business is slack. While this is unquestionably true many business houses do curtail advertising in periods of depression, not because they wish to or because they believe it is good policy, but simply because they feel that they must. Naturally, in curtailing advertising that which is considered least fruitful is the first to feel the pruning knife.

Electric-sign advertising has apparently shown little if any decrease during the past year, although many other forms of advertising have been pared to the bone. The conclusion is, therefore, that electric sign advertising must be considered intensely profitable by the average buyer of electric display space.

Under the present conditions of keenest sales competition there is also a strenuous struggle for the potential buyer's attention. Two merchants, side by side, competing for trade, will certainly not overlook the electric sign as an immediately effective way of compelling attention. If one puts up a sign the other must perforce follow suit. Then the contest is to see whose sign can be made to gain the greater share of interest and attention. In a general way a similar competition goes on between all electric display advertisers. The "Chesterfield" sign attempts to outshine, outflash or outdo by color the "Fatima" sign, the "Cliquot Club" sign and the "Wrigley" sign. Locally, the "McSwat" haberdashery sign struggles for dominance over the sign on the restaurant next door and for a place in the light with the "movie" palace down the street.

It used to be, when electric signs were few and far between, that "any old electric sign" got its full quota of attention. Even with low candlepower lamps, and without motion or color, it had a 100% attention value because it was silhouetted against the surrounding velvet darkness. Now-



Typical Examples of Sign Lighting, Showing the Effects of Contrasted Brilliancy.

adays, there are few locations where the lone electric sign has the field all to itself. Even in the smaller towns and cities there are many lighted signs. Every "Main Street" is a miniature Broadway, differing from New York's Great White Way only in size and magnificence.

There are three ways in which the electric sign may gain added attention value without increased size. The first to be thought of and utilized was color. Just as magazine advertisers, after years of black and white displays, hit upon the use of color pages, sign advertisers too saw the added value of color. The next step was motion. By means of flasher effects and, finally, within the last year or two, there has been a nation-wide movement on the part of electric display advertisers to make their signs more effective by means of greater brightness. In many cases the older 5 and 10-watt sign lamps have been replaced with type C lamps and "Daylight" lamps in ratings as high even as 150 watts. Of course, an indiscriminate replacement of 5 and 10-watt lamps with lamps of high brilliancy might, and in some cases has, neutralized the benefit of added attractiveness by introducing an element of unpleasant glare. In general, the higher candle-power lamps are most effective in the larger and roof-mounted signs.

Sign Lamps of High Wattage Produced to Meet Demand for More Light.

In order to meet the demand for higher wattage sign lamps the lamp manufacturers have made available a line of lamps in ratings from 5 to 100 watts. In particular a new blue sign lamp in 25 and 50-watt sizes has recently been put on the market, which it is believed meets the modern requirements for the majority of signs. These new lamps are brighter and whiter than the 10-watt sign lamps so universally employed in the past. While these lamps are blue in color, and produce a light that verges on white, they should not be confused with "Daylight" lamps in which an effort has been made to approximate the color of noon sunlight.

These lamps are of the vacuum type and do not heat excessively and do not require caps to protect them from the weather. They have been designed with especial consideration for ruggedness, and the bulb length and shape is such that they may be used in sign letters with troughs as originally designed to accommodate 10-watt lamps, thus making replacement by the higher wattage lamps easy and effective. The only feature that needs consideration is the wiring which, with the higher power lamps, may have to be made heavier in some cases. The filament construction of the new lamp produces a concentrated symmetrical light source. Because of the relatively greater "end-on candle power" the lamps have the appearance of brilliant round spots of light when viewed horizontally as in a lighted sign.

For signs which require very brilliant illumination because of their location in the more brightly lighted areas the best effects may be obtained with type C lamps. The 50-watt white mazda lamps have become standard for use in the highest class of signs of medium size where the mounting of the sign is low and where high-power, clear-glass lamps would produce an uncomfortable glare. For the larger signs, when mounted on roofs or other high locations, the most effective illumination is obtained with either type C or "Daylight" lamps. Wherever type C or "Daylight" lamps are burned horizontally and exposed to the weather they should be protected in some manner. Among other forms of protecting devices there is now available a small and inexpensive protecting cap which covers only a small part of the upper surface of the lamp, but which is entirely effective.

While the trend in sign lighting is inevitably towards greater brilliancy and higher wattage lamps, it should not be construed to mean that there is no longer a field for the 5 and 10-watt sign lamps. Wherever the surrounding standard of illumination is low they may still be used to advantage, and they are still of great value when used in masses or for background, or especially for contrast with the higher powered lamps. The effect of massed 10-watt lamps and 75-watt "Daylight" lamps is that of gold and silver.

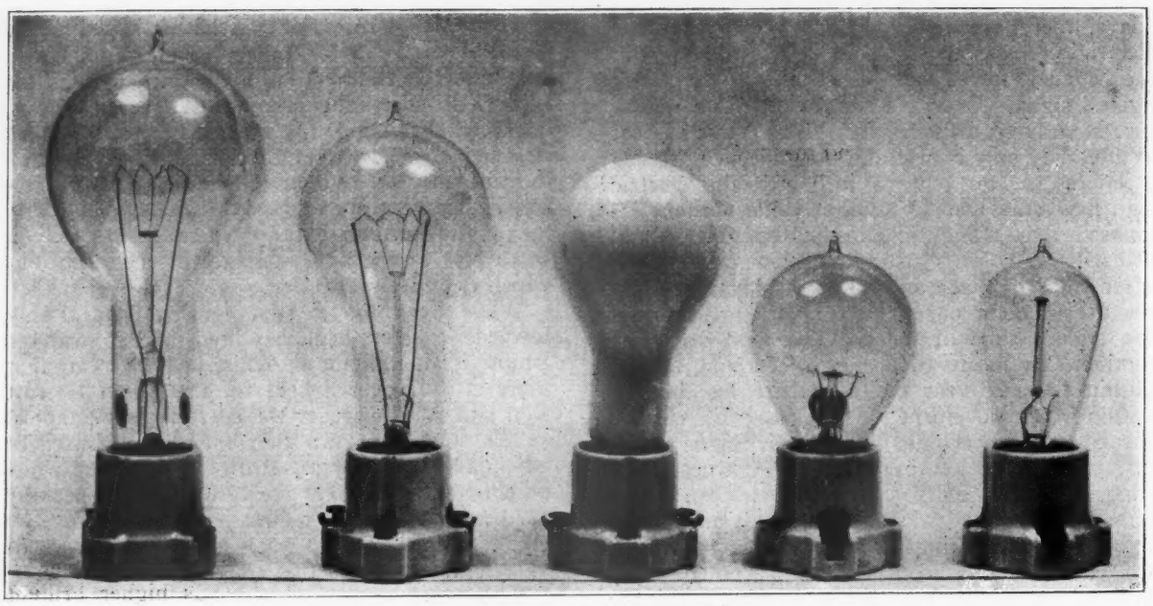
The same tendency towards higher brilliancy is evident for the illuminated sign or billboard as for the "orthodox" electric sign. Where the board carries larger areas white in color, the "Daylight" lamps are especially effective. Very generally high wattage lamps, notably 150-watt type C lamps are used for illuminated billboard service.

Before the war there was a quite popular movement among merchants towards store-front lighting, accomplished by means of one or several high wattage lamps in inclosing glassware suspended over the front of the store. At that time many tiny hole-in-the-wall merchants bought this equipment, installed it and then found it too expensive to operate continuously night after night. This experience, together with the fuel-conservation program entailed by the war, was adverse to the growth of this type of lighting demand. The demand is again growing rapidly and more conservatively, and such lighting is gaining headway among the more prosperous merchants who can easily afford it, as well as among the more aggressive but small merchants who realize its advantages in attracting trade which might otherwise overlook their humble places of business.

Store Window Lighting Developed in Advance of Sign Lighting.

Even before the tide set in for brighter electric signs there was a decided tendency towards better lighted store windows—a tendency which has been constantly augmented. It is odd in a way that progress in sign lighting has been from light, to colored light, to motion and then to more light, while store-window lighting early turned to motion and to greater brilliancy, but is just now turning to the practical application of color in lighting. So much has been written in the past several months regarding the use of color in store-window illumination and of the practical means now at hand to make it at once of use and value to the merchant that nothing need be said here beyond the fact that color illumination for the store window has come to stay and that it must soon become one of the things of everyday modern life.

It is estimated that there are something like



Five Types of Lamp Bulbs Being Employed in Illuminated Signs.

8,000,000 electric sign sockets in use in the United States, requiring about the same number of lamps each year. It requires no wide stretch of imagination to picture an increase of two, three or even four times in the lamp wattage required for these sign sockets if the present higher wattage tendency continues as seems likely. Nor does it require great imagination to foresee a considerably increased revenue to the whole electrical industry as a result. This includes electrical retailers, contractors, jobbers, sign people, central stations and manufacturers of lighting equipment.

Of stores there is a round 1,000,000 in the country, so that each bit of progress in the lighting art, whether it be a step towards higher intensity, a step in the direction of color lighting or a trend towards store front lighting, is immediately reflected as new lighting business in every town and city the country over. And the really encouraging part is that instead of suffering a depression and handicap because of a general slackness in business this particular demand is, if anything, augmented by the keener competition among merchants and manufacturers which goes hand in hand with dull times.

TECHNICAL COURSE OFFERED HIGH SCHOOL GRADUATES.

The Western Electric Co. is offering a special technical training course to a limited number of this year's high school graduates. These young men will be developed for positions of responsibility in the laboratories and drafting divisions of the company's engineering department. The offer is expected to prove very attractive as the Western Electric laboratories are a great center of research and development in the communication field. The members of the new class will be paid while employed. The new course is divided into three units, each requiring a year for completion. It covers the fundamental principles of physics and mathematics and their use in the field of telephony. Careful supervision will be exercised in the assignments to work so that the training may be educative in the largest possible sense.

All the instruction, which will take approximately 6 hrs. a week, will be given on company time within the regular hours of employment. Naturally the students will be required to do considerable study and preparation at home. The salaries of the young men will be readjusted twice a year and will be based upon their records in the class room and their proficiency in their duties. There will be no fee for those who take the course. The only expense will be that involved in the purchase of standard textbooks. Nearly 100 high school graduates from high schools within commuting distance of New York City have already applied for admission. In order to qualify for admission, proficiency in arithmetic, geometry, trigonometry, physics and English is required. The men are chosen on the basis of their achievements in school, and keen interest is evidenced by high school principals, fathers and relatives of the young men in the prospects of the applicants.

ELECTRIC LIGHT PLANT INSTALLED IN THE ARCTIC.

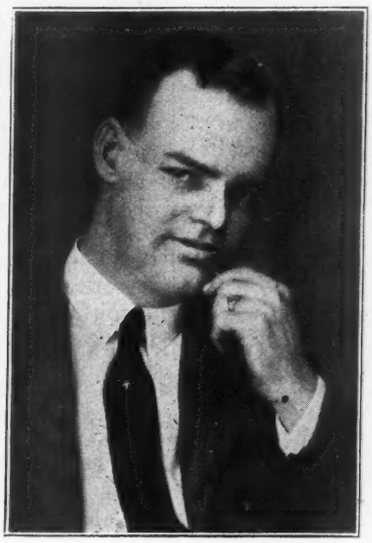
Electric lights have invaded the Land of the Midnight Sun. Arctic "white ways" may soon be established in the Eskimo country to compete with the aurora borealis. Weary city dwellers, who have long envied the inhabitants of the Northland their opportunity to sleep 3 mo. of the year without interruption, have lost their cause for envy.

An electric light plant has been set up at Kodiak Island not far from Cook inlet, Alaska, and little Aleuts studying in the Baptist Mission school there, pore over their lessons through the dark months of November, December and January with the aid of electric lights, not so picturesque as the sperm oil lamps, but far easier on youthful eyes. Thus is electricity searching out and enlightening the earth's dark corners.

The Beatie Plan for Marketing Lighting Fixtures

Satisfaction of Customer Assured by Manufacture of Fixtures of High Quality Selling at Prices Within Reach of the Average Purchaser — Quantity Production and Selling Reduces Costs

S. T. Beatie of R. Williamson & Co. has set himself the task of marketing lighting fixtures of real quality under conditions intended to prove attractive to every individual concerned. Already a number of manufacturers have associated themselves with the new movement, and others are considering seriously the advantages of such a connection. It is expected that many more will be drawn into the group when the actual evidence of success begins to develop. Fixtures are in demand and manufacturers are willing and anxious to produce them, but too often the completion of a transaction has failed to prove entirely satisfactory. It is the removal of the elements of dissatisfaction that Mr. Beatie has assumed as his duty—he is taking up this task in an effort to serve "Mr. and Mrs. Public," as he characterizes the buying power of the country. The expressed object of the Beatie plan is to supply good equipment—not merely better equipment—at prices that are attractive to the purchaser and profitable to the contractor-dealer as well as the manufacturer and jobber.



S. T. Beatie.

It is easy enough to see the merits of such an accomplishment, whether the goods involved happen to be lighting fixtures or any other articles of real utility. The progress already made, when considered in the light of what has been accomplished by Mr. Beatie as well as by others in other fields, points to the ultimate success of the entire proposition. Already a substantial portion of the final organization has been completed, and enough preliminary successes have been accomplished to satisfy expectations.

The plan involves the manufacture in quantities of fixtures of artistic quality and substantial construction, and the marketing of these fixtures through one central organization. Quality in design is assured because of the fact that only designs approved by Albert Wahle will be manufactured, whether the fixture be the lowest priced or the most expensive on the list. No needed expense will be spared in perfecting the designs and patterns, for these costs can have but little influence in the ultimate price of a fixture when thousands are to be produced. Quantity production, with its reduction in overhead costs, allows for the expenditure of whatever sum may be required to provide good materials and workmanship, without piling up an unwarranted total cost. Thus good and substantial fixtures are assured in addition to good design.

In order that the efforts of the designer be not lost by the improper assembling of good parts to form misfit fixtures, every fixture is to be packed as a complete unit in a separate substantial carton. Under such a plan handling costs are reduced to the minimum and breakage is practically eliminated. Carton goods can be handled by the jobber, by the dealer and by the man who actually puts them up with much less confusion than results where parts and pieces must be collected together in odd shaped packages. Also, the carton scheme eliminates the necessity of unpacking and repacking in the jobber's stockroom and again in the dealer's store. One final inspection in the assembling room of the factory is all that is needed to insure that the package is correct in every detail. After that inspection, and after the package has been sealed, there is nothing left to do but count the box as it is received by the jobber and dealer—the parts are all there and cannot be inadvertently mislaid.

It is easy enough to draw a picture of this kind of a plan, but it is something else to make the picture plan take on a material form and become an actual working proposition. So far, Mr. Beatie says, seven manufacturers and a number of jobbers have adopted the plan and are placing their equipment and organizations in a position to carry it through. Stocks of patterns are being overhauled and duplicates are being discarded. Where necessary, to meet the approval of Mr. Wahle, patterns are being altered before production is initiated. Orders are now in hand in such quantities as to satisfy Mr. Beatie and his associates that ultimate success is assured.

There is no question but that the average purchaser wants to have good lighting fixtures, and the industry wants to give the average purchaser what he desires. By eliminating duplication of production overhead, and by doing business through dealers and jobbers who can and will produce results, it is proposed to satisfy the aver-

age purchaser both as to quality and price, and at the same time leave a good margin of net profit for the industry. With dealers and jobbers seeking business in every part of the country with one complete list of designs, instead of 7 or 15 or 30 partial competing lists, with reduced prices, with improved quality, and with the enthusiasm inspired by Mr. Beatie and his organization, it seems evident that much should be expected of the near future.

Straight business will bring results, Mr. Beatie says. "Only sell a man what you would want to buy if you were in his place." "The sale and purchase should be a deal for commodities that are actually needed." "The jobber can undersell present manufacturers' prices." "Shoot straight and play square!" These are some of the remarks made by Mr. Beatie in speaking of his plan and in reply to questions. He says that more business principle can be learned from watching a crowd of boys play ball than from attending a directors' meeting. The boys live all in the present, and every decision must be made on its own merits. Mr. Beatie believes that such principles applied to the fixture industry are bound to win the approval of the public, and he is backing the idea to the limit. High quality, low price and satisfaction are the goods he has to deliver.

MODERN LIGHTING INSTALLATIONS ON PASSENGER STEAMSHIP.

Description of Fixtures and Lamps Used for the Illumination of Dining Saloon and Other Portions of a Big Pacific Liner.

The effective lighting installations on the S.S. *President* of the Pacific Steamship Co., running between Seattle and San Francisco, are shown in the accompanying illustrations. One of the illustrations gives an excellent view of the social hall, illuminated mainly by 75-watt and 100-watt lamps, but including several 200-watt units. The other views were taken in the dining room where lights of similar capacity are shown. These are all type C lamps, installed with the "Perfeclite" type of fixtures for evenly diffused lighting. The entire installation comprises 127 "Perfeclite" type C.C. units of 7-in. monax glass bowls, and several of the H.O.R. type with 10-in. bowls. The installation produces a strong uniform light so well disseminated as to break up the glare and eliminate shadows.

Social Hall in S. S. "President" Illuminated With 75- and 100-Watt Lamps.

Steamship Dining-Room Illuminated With 75- and 100-Watt Lamps.

The fixtures, as assembled for these units, have some features of special interest. One of these consists of a concave disc above the lamp in the upper part of the bowl. This disc is set with a battery of mirror reflectors that take the upward rays from the lamp and reflect them downward. Each mirror is adjusted to such an angle as to result in the proper diffusion through the monax glass bowl. Without these mirror reflectors the upward rays would be partly wasted. The arc formed by the battery of mirrors showers the light through the bowl, diffusing it over a wide area. According to data furnished by the Perfeclite Manufacturing Co. of Seattle, the monax glass globe, which is of egg-shell thinness, absorbs only from 5 to 9% of the light. The light in passing through it is softened and uniformly diffused.

In this installation the illuminating unit is suspended from special copper fittings attached to the ceiling. Similar units are made for numerous sized lamps, not only for ceiling lights, but for hanging lamps and bracket installations.

WESTERN ELECTRIC CO. ADDS NEW SALES DISTRICT.

The Western Electric Co. has rezoned its sales territory. A new district, called the Atlantic District, has been established with R. W. Van Valkenburgh as its first manager. It includes the area covered by the Philadelphia and Pittsburgh houses, which formerly was part of the Western District. Headquarters will be located in the former city.

The institution of the Atlantic District gives the Western Electric Co. six strategic subdivisions in the United States. The others are the Eastern, Southern, Central, Western and Pacific Districts. The new seaboard territory not only includes most of Pennsylvania but also Maryland, Delaware, southern New Jersey and southeastern Ohio.

SUPPLIES OF CLAY FOR MAKING HARD PORCELAIN SCARCE.

The most important among the industrial products of Archi Prefecture in Japan is porcelain, and although two or three of the biggest factories are in Nagoya, the greatest number of manufacturers are located in Seto-cho. The producers, however, are very pessimistic with regard to the future of the industry for, while the deposits of

clay suitable for making coarse ware are practically limitless, it is said that the "kabushi" clay, a superior grade of fire clay found in the neighborhood, suitable for making hard porcelain and incomparably superior for use in the electric smelting furnace, is almost exhausted. "Kibushi" clay of an inferior quality is also dug at Kozoji and in the Tono district, but so great has been the demand for the Seto-cho variety that the privately owned deposits have been almost used up and the produce s have had to secure permission to dig in the prefectural forest lands. It is not known how much of the ground under the 19,600 acres of prefectural forest area has deposits of "kibushi" clay, but it will doubtless also become exhausted in time, so that it is necessary for the porcelain manufacturers to use this material most economically to safeguard the future of their industry.

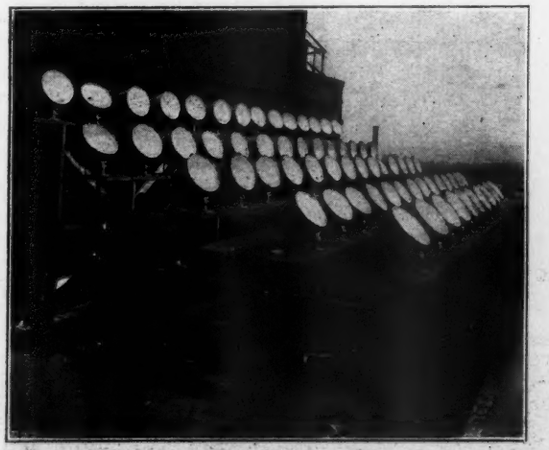
LIGHTING THE WRIGLEY BUILDING, CHICAGO, AT NIGHT.

Front of Building and Four Sides of Tower Flood-Lighted With Batteries of Powerful X-Ray Reflectors.

The new Wrigley office building in Chicago is a veritable jewel at night that stands out against the dark sky like a sentinel clothed in snow-white, guarding all approaches to the city. The entire front of the building and four sides of the tower are flood-lighted with batteries of powerful X-Ray reflectors.

It is stated that 129 No. 60 X-Ray projectors with 500-watt lamps, produce over 20,000,000 cp. that makes the building loom out in all its grandeur. A total of 86 projectors mounted on buildings opposite light the front of the building and two sides of the tower; batteries of 43 units on the Wrigley building roof light the other two sides of the tower. At a distance of 15 to 18 mi., it stands out clearly in relief against the night, guarding to harbor the ships plying the Great Lakes.

The building is of irregular shape and stands 400 ft. above the street level, or 34 stories in height. It is of a very light terra cotta and is lighted so that the intensity gradually increases until the tower itself is all aglow. It is lighted every night until midnight and without a doubt was one of the big features of the Pageant of Progress held in Chicago July 30 to Aug. 14. It will be washed as often as is necessary to keep it snowy-white.



One of the Batteries That Light the Wrigley Building.

Wrigley Building, Chicago, at Night, Flood-lighted With X-Ray Reflectors.

Wild West Show Grounds With 113 Lamps of 1000-Watt Capacity Burning.

LIGHTING INSTALLATION FOR WILD-WEST SHOW.

Great Open-Air Arena Illuminated With Equipment Suspended From Standard 0.25-in. Steel Messenger Wire.

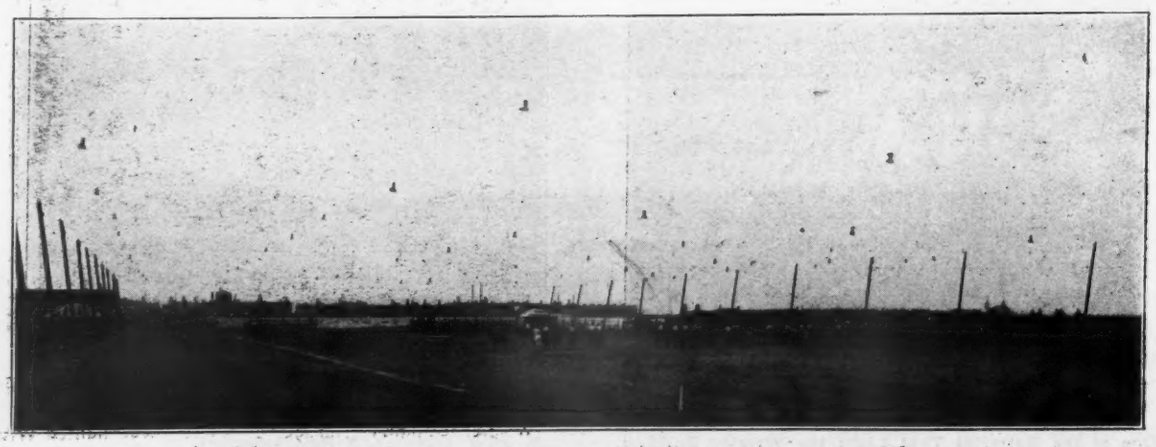
Night performances of the "Wild West Show," held in Grant Park, Chicago, were vastly more successful than the ordinary open-air night show because of the high quality of illumination provided. As may be seen from the illustrations, the light was all supplied by units suspended on overhead messenger wires. The distance across the arena was 365 ft., and there were 14 strings of eight lamps each suspended over the field. The total length of the field was 700 ft. In all there were 113 lamps rated at 1000 watts installed. Each lamp was mounted in a deep bowl porcelain enameled reflector supplied by the Central Electric Co. The reflectors with a bracket for suspension and attachment of wires, and with the sockets and lamps in place, weighed 6.5 lbs. each.

Suspension System Adopted Proves to Be Entirely Satisfactory.

The overhead span wire, which was an ordinary 0.25-in. stranded-steel cable, was fastened at each end to a 40-ft. by 8-in. wood pole set 6 ft. in the ground. The cable was fastened to the pole at a point about 1 ft. below the top and the pole was guyed from this point to a 5-ft. harpoon anchor set back about 15 ft. from the base of the pole. As may be noted in the illustration, the poles were raked slightly to help hold the strain. The reflector, attached to the center of a metal bracket carrying an insulator at each end, was suspended about 6 ins. below the steel cable, and the two No. 6 feed wires were carried across the field on the insulators connected to the brackets. The insulators were perforated and the wires were carried through the holes. This gave a type of suspension fairly free from swaying, although considerable movement is to be expected with any kind of suspension construction.

Transformer capacity amounting to 100 kw. was installed to supply this equipment, energy being supplied at two different points. Good time was made in the erection of the installation, only 6 days being required to complete the entire job. The Monroe Electric Co., Chicago, made the installation.

Alabama Power Co. has received a license from the Federal Power Commission to erect a 120,000-hp. water power development on the Coosa river in Alabama at a location known as Duncan's Riffle. Work has been started on the project which will comprise a concrete, gravity type dam 1200 ft. long, to develop a head of 68 ft. The initial installation will be two 24,000-hp. vertical units with turbines of single runner type, directly connected to the generators and with provision for the installation of three additional units as the demand from the market may require.



Day View Showing Lighting Installation for Outdoor Wild West Show.

Industrial Lighting With Mercury Vapor Lamps

Characteristics of Light Suitable for Successful Industrial Illumination — Mercury Vapor Lamps Used in Automobile Plants and for Similar Service — Higher Lighting Standards Required

By E. L. ELLIOTT

In all times previous to the present century there was but one kind of light in use for the regular purposes of illumination. Sunlight was the standard, and all artificial sources produced light of the same type, but varying somewhat in general effect; that is, it was all the highly complex light characterized by a continuous spectrum, the differences consisting in the comparatively slight variation in the relative amounts of the different colors contained. All artificial light was produced from glowing (incandescent) solids, and contained all the colors of sunlight, but with the orange and yellow rays in larger proportion. Light of this quality is entirely satisfactory for the social and leisure activities of civilized man; in fact, it is preferred to sunlight in many cases—as in theatres. Being the best then obtainable it was also pressed into service as a substitute for sunlight to make possible the continuance of labor when natural illumination failed. This substitute at its best, however, has never been considered the full equal of standard sunlight for the practical affairs of industry, an opinion which we now know from scientific demonstration to be correct.

Early in the present century the researches of Peter Cooper Hewitt resulted in the development of a commercially practical method of producing light of radically different type from that of the old familiar sources. Instead of using a glowing solid as the light-source, he made use of a body of glowing vapor. The vapor of mercury, con-

Example of Factory Construction of High Character, Employing Individual Motor Drive and Cooper Hewitt Lamps for Night Illumination.

tained in a glass tube exhausted of air, met the conditions requisite to a practical electric lamp. The light produced by glowing mercury vapor is very simple in its composition; it contains practically but three colors—yellow, green and blue—of which the yellow and green constitute 90% of the effective light. In other words, the light has a simple line spectrum characteristic of the element mercury in distinction from the continuous spectrum of the light from the sun and from incandescent solids. In considering the general problem of artificial lighting the most salient fact that confronts us is that we have a choice between two radically different kinds of light, each equally practical and available as to its production and distribution.

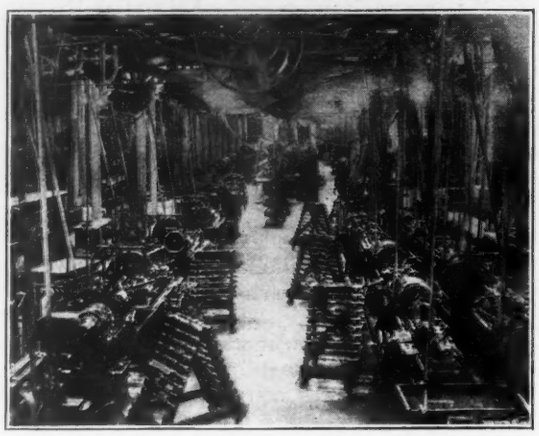
Now, if we apply the first implement of science—analysis and classification—to the subject we arrive at a division into the two principal classes; social lighting and industrial lighting. The shortest way of defining the two classes is to assign to industrial lighting all cases in which light is used in order to carry on manual labor, and to social lighting all other cases. The line between the two divisions is fairly sharp—sharper than in most cases of broad classification. We might define the two classes colloquially as "white-collar lighting" and "overalls lighting," the distinctions being quite obvious if less elegant.

Good Industrial Lighting Should Reveal Details Sharply.

The essential requirement in each case is likewise distinctive. In social lighting it is desirable to suppress certain details and to soften and blend outlines. In industrial lighting the exact reverse of these effects is essential; all details must be revealed as sharply as possible, and all outlines must be clearly cut. The second fact that confronts us in our analysis of the subject is the most important single fact in the whole field of the applied science of light. It is this: The essential qualities of the two different kinds of light exactly fit the essential requirements of the two general divisions of lighting. The mellow tone of incandescent light, resulting from its preponderance of orange and yellow, subdues just those points that we like to have subdued in our occupations of leisure and social intercourse, while affording ample visual clarity for all requirements under the circumstances.

On the other hand, the light of mercury vapor has a remarkable revealing power. Fine details that can be discerned only with difficulty, or not at all, under continuous spectra light are readily distinguished under the simple light of mercury vapor. This is the direct result of the construction and operation of the optical apparatus of the eye. It is a physical impossibility for the lens of the eye to produce a sharp image on the retina with the complex light of the sun and incandescent solids; and it is the image on the retina that we actually see, just as it is the image on the film that we really photograph. The increase in visual acuity produced by mercury vapor light is equivalent to a very perceptible magnification. This virtual magnifying effect is often sufficient to render the use of weak spectacles unnecessary. Where quick and accurate perception of fine details is necessary, as in the inspection of manufactured products for minute structural or mechanical defects, mercury vapor light has entirely replaced sunlight in some establishments.

A still more remarkable fact has recently been discovered which is undoubtedly an indirect result of the increase in visual acuity. This fact has been established by means of the modern



Automatic Lathe Department Illuminated for Continuous Production.

methods of experimental psychology. From a series of experiments including some 40,000 observations it appears that the muscles respond, or react, more quickly to the visual impressions produced by mercury vapor light than by impressions on the same object produced by sunlight, or incandescent light, of equal photometric intensity. In the language of the science of psychology visual reaction time is shorter under mercury vapor light than under daylight or incandescent light of equal visual intensity. A further fact which one prominent illuminating engineer rightly described as startling, and which was brought out in this research, is that at all intensities above 5 foot-candles mercury vapor light surpasses all forms of continuous spectra light at any practical intensity (from 5 to 50 foot-candles). Translating these results into terms of labor efficiency it means that a workman who would make 100 motions under standard daylight conditions would make 106 motions under mercury vapor light and 97 under the best quality of artificial light produced by incandescent solids.

Quality of Light and Shape of Source Reduces Deep Shadows.

The operation of the eye, including the special nerves and brain-centers which convert its optical effects into thoughts and actions, is facilitated by another peculiar quality of mercury vapor light. The eye can see with less light of the simple composition of mercury vapor light than it can with the complex light of the ordinary sources. This peculiarity, reduced to practice, means that there are no black impenetrable shadows under properly installed mercury vapor lighting. Measured by the photometer the shadows are there, but measured by the ability of the eye to distinguish objects they are practically absent.

Obliterations of troublesome shadows is further secured by the mechanical construction of the Cooper Hewitt lamp, the illuminant of which consists of a glass tube some 4 ft. long. The result of this construction is that the light

actually "shines around" objects of smaller dimensions—which includes the workman's own body.

Another characteristic of mercury vapor light which has an important bearing on the general problem is its freedom from glare. The large luminous surface has a brightness of only 15 c.p. per sq. in., which can be met by the eye without discomfort or inconvenience. It is the only modern light source that can be safely used without more or less elaborate accessories for diffusing the light so as to reduce glare.

As a final consideration mercury vapor light is easiest on the eyes, owing to the fact that its light is the coolest. It contains no red rays, which are the hot rays. Its radiations are practically all light; that is radiations which have the greatest power to produce the sensation of vision. Hence, the eye sees with less effort and, consequently, with less fatigue. The final test by which the merits of any system of illumination must be judged is the efficiency of labor performed under it as compared to the efficiency of the same labor performed under standard daylight conditions. The factors involved in the problem are: First, reaction time—the time required for the muscles to react to the visual impression; second, visual acuity—the power of the eye to distinguish fine details; third, hindrances to visual perception—obscurity in shadows, glare, and insufficient light, and fourth, visual fatigue resulting in mental and physical fatigue. The first and second of these factors are positive, the third and fourth are negative, and the final result is their sum. The solution of any special case will be reached when the sum is a maximum.

In its unprecedented career of development to a state of mechanical perfection the automobile industry has had the inestimable good fortune of being unhampered by precedent and tradition. Under these circumstances we would expect to find something of the same spirit of open minded investigation applied to the problem of lighting. Generally speaking, in no other line of mechanical production is the percentage of good illumination so high. The old notion, now discredited scientifically, that it is impossible to turn out work as efficiently by night as by day, has been relegated to the scrap pile, and the production sheets in the best lighted shops show more pieces turned out on the night turn than during the day.

Reaction time.—Although the automatic machine has been developed to a marvelous extent, and is superhuman in its power and speed, it can never be fully automatic. The final cost of any given product of manufacture is, after all, determined by the amount of human labor expended on it. The most perfect machine made cannot renew its own parts, nor set itself up for a job, nor supply itself with work, nor inspect its own product, nor perform the final work of assembly.

The human machine is the only one that is wholly self-contained and self-controlled. It is estimated that 70% of all human actions are guided by the sense of vision. Probably a still larger proportion of the motions used in labor are so guided. The visual organs are the great central control system of this infinitely complicated machine. Reaction time, the time it takes a workman to make a motion, is the final basis of labor efficiency, and hence of labor cost. To secure the utmost in reaction time is therefore the first and most important consideration in providing a lighting system for any particular branch of industry.

Visual acuity.—As reaction time is the basis of labor efficiency, so accuracy is the basis of efficiency in mechanical construction. "Interchangeable parts" is the foundation of modern production; and this means duplication with a high degree of precision. Whitworth, the great pioneer of precision methods in England, was fond of telling how in his apprenticeship they tested the fit of a piston in its cylinder by dropping in a shilling piece, to see if it would rattle through. Now, a thousandth of an inch is too coarse a measure for the finest classes of work. While the unaided eye is unable to make direct comparisons of such magnitudes the fact remains that the demand upon vision for accuracy of perception is greater today than ever before. Particularly is this true in the numerous operations of inspection which are literally matters of life and death in the case of automobile construction. Other things being equal, there can be no question of the advantages of a system of illumination which not only permits the eye to perform its regular function, but actually increases its power of distinguishing fine details and minute objects. Next to reaction time visual acuity is the most important factor in industrial lighting.

Hindrances to visual perception.—Most of the directions given for securing good illumination are devoted to telling what not to do. This was a natural procedure when there was only one kind of light to be had. Good or bad illumination was then a matter of reducing the inherent shortcomings of the different kinds of lamps to a minimum. The most conspicuous fault of all the modern solid radiant light sources is their dazzling brilliancy, which has increased as they have advanced in efficiency. The effects of this fault in all its numerous phases have been treated under the single term, glare. No other factor in lighting has been so much studied and discussed. So far as industrial lighting is concerned the elimination of glare is so simple a matter, and one which so naturally follows the choice of the type of light to be used from the more important considerations of reaction time and visual acuity that it does not directly enter the problem. Mercury vapor light does not produce glare; hence there is no problem of its elimination.

Next to the troubles arising from glare the difficulties encountered in respect to shadows have constituted the most obvious difference between natural and artificial illumination. Like glare, these difficulties increased with the progress of solid radiant light sources, due to the fact that increase in efficiency has been secured by increasing the brilliancy and decreasing the size of the radiant. Shadows are absolutely necessary to visual perception, since they produce those effects in perspective which we commonly call "roundness" and "depth." Without shadows all objects would appear flat. Trouble arises when the shadows are so dark as to obscure objects and details within them that must be clearly distinguishable, and when their outlines are so sharp

as to confuse the shadow with the object.

These difficulties are more than usually in evidence in automobile construction. There are many cases in which it is necessary to look into cavities and covered spaces, to see under as well as over and within as well as without. This matter of shadow is one on which the ordinary photometer measurements give no reliable information. The green light of mercury vapor has so much greater visual power in the lower intensities that "equality of brightness" measurements, as given by the photometer, lose their significance. As before pointed out, the large size of the radiant in the Cooper Hewitt lamp prevents the formation of sharply outlined shadows. Shadows as a factor in our problem can then be treated as we treated the factor of glare; the elimination of troubles from this source is a matter of the choice of the kind of light to be used rather than in the kind of accessories.

Insufficient light.—It is only within the past few years that electric light has been given a fair show; that is, been produced in illumination intensities comparable to those of the daylight illumination which we would consider satisfactory. And not until the present year have we actually known that intensity is necessary for the most efficient vision where sharp focussing, such as we use in reading, is required. The psychological experiments before mentioned gave the first positive knowledge on this important question; they showed that 10 foot-candles is the minimum under the most favorable conditions of contrast and absence of disturbing factors. This minimum is practically the same for all three kinds of light; viz, sunlight, solid radiant electric light, and mercury vapor light. That is, the best that can be done under each kind of light is reached at approximately the same intensity, but is different for each light. Insufficient light is probably the most common and serious fault in industrial lighting at the present time, but less frequent in the automobile industry than in the older lines of manufacture.

Fatigue.—"Eyestrain" and its resultant fatigue and other more aggravated results have been much studied and talked about, but with less positive results in the way of demonstrated fact than could be wished. The subject needs thorough investigation by modern psychological methods. There is every reason to believe that the quality of light will have an even greater effect in this respect than it has upon reaction time. Both theory and practical experience tend to confirm this belief. This much is sure; in the cases where a regular night shift is operated under mercury vapor light the production has always equalled and in not a few cases has exceeded the output of the day-turn. This would indicate that there is at least no more fatigue under this light than under daylight. Some of the most representative cases of this kind are in the automobile industry.

So much for the application of the scientific principles of lighting to the special case in hand; how does the practice in this field correspond with the theory? A fair reply is: to an extent quite comparable to the general knowledge of these principles. To begin with, the largest automobile plant in the world, after careful and thorough tests, is equipped throughout with the system which best fulfills the requirements of the theory, the illumination being supplied by some 15,000 Cooper Hewitt lamps. The plant is operated on the continuous plan; i.e., there is no cessation of work except for the Saturday and Sunday holiday.

From this all along the line there are similar cases of lighting for continuous and maximum production. The last entrant into the field to attract special attention on account of the unique features of the car produced, the Wills-St. Claire, is in line with the older members of the craft in respect to lighting equipment. And so we might go from case to case. But it all comes to this: the lighting in the automobile industry is generally typical of its advanced position in mechanical and industrial engineering.

ELECTRIFICATION OF THE ITALIAN RAILWAYS.

Work on the general electrification of Italian railways is proceeding actively. At the end of last August, 10 roads, comprising a total of 797 kms., had been electrified. From Sept. 1, 1920, to June 30, 1921, five additional roads, comprising a total of 234 kms., were electrified. During the current year 434 kms. of road will be electrified. The saving in coal resulting from these electrifications amounted, at the end of June, to 160,000 tons. By July 1, 1922, it is calculated, the saving in coal will reach 1000 tons a day, causing a daily saving of 200,000 lire, or 70,000,000 lire annually.

At the end of August, 1920, the sole generating plant worked by the railways of the state was that of Mordegno, with a capacity of about 5000 hp. and normally working with about 3800. Various works have now been begun and are being carried on and finished by means of designs and contracts approved recently by the second section of the Superior Council of Waters.

INCREASED TAXES FOR OKLAHOMA PUBLIC UTILITIES.

The Oklahoma state board of equalization recently increased the assessed valuation of public service corporation property about $6,000,000. This increase represents improvements made by the utilities during the past year. The property was assessed on the same basis as for last year, plus the value of improvements. The Oklahoma Natural Gas Co. will pay taxes for this year upon a valuation of $7,825,552. Other large assessments of public service corporation property included: Oklahoma Railway Co., $3,118,586; Oklahoma Gas & Electric Co. (tentative assessment) $4,254,821; Gulf Pipe Line Co., $10,191,610; Magnolia Pipe Line Co., $7,096,780; Tulsa Street Railway Co., $300,000; Muskogee Electric Traction Co., $335,000; Guthrie Railway Co., $25,000; Oklahoma Union Railway Co., of Tulsa, $226,000; Pittsburgh County Railway Co., $400,000; Sapulpa Interurban Railway Co., $50,000; Shawnee-Tecumseh Traction Co., $55,000.

The bankruptcy receiver is now calling upon those who sat idly in the office waiting for competitors to hustle out and find prosperity.

EDITORIAL COMMENT

Political Football

James A. Perry of Atlanta, Ga., president of the National Association of Railway and Utility Commissioners, recently said in a public address: "I know of no greater curse to the business interest of a community than where agitators by whatever name you call them, some running for one office, some for another, have been allowed without answer to disseminate alleged facts in derogation of practical, legitimate utility development."

The Beatie Plan

Much has been printed and much more has been said about home lighting from a technical point of view, but not so much has been done in a big way to bring the best of equipment within the reach of the average family. To be sure, good fixtures are obtainable at prices that appear to be within the means of many, but an inspection trip through the homes of any town or city will reveal the fact that good fixtures have not been installed except in a small percentage of cases. However, it is now promised that good fixtures will soon be available for everyone who wants them at prices below those of the goods of inferior design or construction. The new plan of manufacture and merchandising, according to S. T. Beatie of R. Williamson & Co., will prove to be profitable to the industry as well as serving the public at a marked saving.

Surely there is little left to be desired after the producer, the merchant and the ultimate consumer have been satisfied. There is and always will be a demand for exclusive designs, and there will always be manufacturers fitted to supply this demand, but the general public does not require an exclusive design for each home. The public demands or should demand good quality and pleasing design, and with several hundred good standard designs available there is no necessity for having fixtures just like those next door.

With service at moderate cost, many sizes and styles of lamp bulbs available, good fixtures at modest prices, and a good understanding of the principles of illumination, there seems to be no reason why the average man should not have home lighting of real merit. If the Beatie plan can supply the fixtures, and there seems to be no doubt on this point in the minds of those who have gone over the proposition with Mr. Beatie, then the last element required to popularize "quality" home lighting will have been provided. Much thought and effort has already been expended in bringing this proposition to its present standing, and it should not be difficult for a manufacturer, jobber or dealer to review the entire situation and determine whether or not he would profit by co-operation. At least it should be worth an investigation, and from the information at hand it seems that it should be worth vastly more.

Milwaukee Fixture Market

National attention will be directed toward Milwaukee during the week of Jan. 30-Feb. 4, when that city elaborately celebrates America's first "Better Lighting Week" coincident to the joint meeting of National Council of Lighting Fixture Manufacturers, Lighting Fixture Dealers' Society of America and the Glassware Guild. In addition to this there will be the big Fixture Market in Milwaukee's mammoth Auditorium, a view of which was presented on p. 245 of the Aug. 13 issue of ELECTRICAL REVIEW.

The Milwaukee Chamber of Commerce and the railroads are advertising the great event extensively throughout the country, while the entire citizenry is enthusiastically boosting it. They are all co-operating to make the combination event the greatest illuminating display in the history of the country.

Secretary Hofrichter, of the National Council of Lighting Fixture Manufacturers; Secretary Wolf, of the Dealers' Society, and Secretary Jenkins, of the Glassware Guild, spent several days last month in Milwaukee going over the ground and making preliminary preparations. The Milwaukee members of the three associations gave valuable assistance.

The Municipal Auditorium, where the Fixture Market and sessions of the conventions will be held, is a highly modern building of imposing dimensions, covering an entire city block and convenient to all the best hotels and places of amusement. The main auditorium has a seating capacity of over 8000 and presents 29,423 sq. ft. for exhibiting purposes. Directly below it is Mechanics Hall, the main exhibition room, 256 by 184 ft., easily accommodating 150 large booths. It is completely wired for both a-c. and d-c. service. Six smaller auditoriums give the building a total of 104,952 sq. ft. for exhibiting purposes, and a seating capacity of 13,520 persons.

The program will be a choice combination of instructive and pleasurable features. The usual

pleasant lunches which marked the previous convention will be even more enjoyable than before, partly because of the excellent facilities of the building for that purpose. While it is too early to give detailed information as to the program and features of exhibits, all signs point to a most successful event.

Bearing False Witness Against Electricity

With monotonous regularity the daily newspaper reports of fires carry some variation of the alibi, "The fire was due to crossed electric wires." These first reports are generally followed by a more thorough investigation by fire officials and insurance men which discloses that the fire was caused by something entirely different, but the correction of the false testimony against the electrical installation seldom reaches the public through the columns of the daily press and, in the few cases where such a correction is given publicity, it is buried in a small item in an obscure part of the paper. As a consequence, the first report, which is read with the keen interest accorded fresh news, remains fixed in the public mind, and electricity again receives an unmerited "shot from ambush."

Occasionally an editor of a daily paper sees the light or has the truth forcibly laid before him and he seeks to undo the wrong to the best of his ability. Such an occasion was grasped by the New York *Herald* a few days ago. When the great U. S. Army warehouse on one of the piers in Hoboken, N. J., burned recently the news was sent out all over the country and prominence was given to the assertion that the fire was caused by defective insulation. In its editorial columns of Sept. 1, the *Herald* printed the following:

"Immediately after the great fire on the army piers in Hoboken the other night it was gravely announced that the cause of the flames was supposed to be 'faulty insulation' of electric conductors.

"It is of course possible that the North River pier fire was due to faulty insulation. If it was, the officers responsible for the upkeep of the property are responsible for the faulty insulation. If the wiring on the piers was done as it should have been in the beginning and was kept under intelligent inspection, there was no chance for faulty insulation. If the work was not done well originally, or if inspection and repairs were neglected, the insulation may have gone wrong. In that case the blame rests with the men charged with upkeep of the plant.

"The fact is, the charge that faulty insulation is responsible for fires is a convenient way of hiding ignorance. Nobody is likely to come to the defense of the wiring. Far fewer fires than are generally supposed originate in electric apparatus, and such apparatus is as safe as any human device can be when it is properly installed and treated.

"It was once popular to attribute all fires of mysterious origin to the act of God. Later, spontaneous combustion came into official favor as a cause of fires, but when it was realized that this commonly meant gross carelessness in handling wastes it lost some of its popularity. Now, incendiarism and faulty insulation are the refuges of those who make official guesses to explain conflagrations. As soon as it is generally understood that faulty insulation spells culpable neglect it is to be expected this phrase will be laid aside."

Engineering Foundation and the Gyro Compass

Research applied to the problems of navigation is, in the single instance of the gyro compass, producing enormous savings in ocean commerce, according to Elmer A. Sperry, inventor and member of the executive board of the Engineering Foundation, who, at the last commencement, received the degree of doctor of science from Stevens Institute of Technology, Hoboken, N. J. Mr. Sperry is one of a group of scientists and engineers headed by Charles F. Rand who are seeking through the Engineering Foundation, founded by Ambrose Swasey, to organize American industrial research on a permanent basis. Tremendous progress, it is stated, has been made in research by the nation since the signing of the armistice, and the next report of the National Research Council will show that within this period many hundreds of laboratories have been added to those devoted to this kind of industrial effort. Through the results of research trans-Atlantic liners are now operating more scientifically and more cheaply and naval warfare has been made vastly more effective.

The gyro compass, with which such ships as the *Mauretania* are able to steer so straight a course that the saving in the fuel item alone has been found to be the entire cost of the equipment every few hundred hours of service, was perfected as the result of research begun after the inventor had watched his three small sons playing with some mechanical toys, said Mr. Sperry, illustrating the part the Enginering Foundation is beginning to play in industry. "It is nothing short of wonderful what can be accomplished by research if properly applied to even the smallest clews. This is illustrated by the gyro compass, which is now rapidly taking its place as a navigational instrument of high precision," continued Mr. Sperry.

"The magnetic compass (originating in China and being rapidly adopted by all mariners long before the cardinal points were known by any such names as North, South, etc., when animals, direct or in conventionalized forms, were used to designate direction) was an instrument of infinite service, especially when all ships were wooden or when wood predominated as a building material for ships. When magnetic compasses were used on iron and steel ships a new set of conditions came in that upset all previous calculations, and it was found that the magnetic needle much preferred to content itself by pointing at a north pole which had been riveted into the ship at some point in its structure than to point at the earth's north pole many thousands of miles away. As steel ships commenced to be used it was found to be a very difficult task to tease the magnetic needle into anything that simulated decent behavior. On these ships at the present day, when the compass is finally adjusted and fully compensated, it breaks out in a new field of misbehavior and positively falls down on its job and fails because, as a matter of fact, it becomes so sluggish and enfeebled by the various compensating means that it seriously impairs its usefulness.

"Again, the magnetic compass is subject to all sorts of disturbances by electric storms, local attraction of great ore bodies, and the original disposition and shifting of cargoes—the latter without the least warning will throw and hold the compass way out of its indication. Think of the usefulness of a magnetic compass in a submarine, where it is entirely surrounded by steel and in more or less necessary proximity to cables carrying 3000 to 4000 amperes d.c., which of themselves will affect a compass needle at a distance of a good fraction of a mile. It is in the greatest contrast to this performance that we find the gyro compass. Here we have indications that deal with true geographical meridians with a high degree of precision, there being no such thing as deviation of variation. Magnetism has nothing to do with it—we care not in what magnetic condition our ship is; in fact, there are no forces known that will disturb a properly constructed gyro compass. Here when the ship changes its heading even 0.1 deg., not only the master compass but even the repeaters indicate it perfectly and with zero time lag. In consequence quite unsuspected results are being achieved in point of saving. It is found with a gyro compass that a course can be steered so that when looking back at the wake it is as straight as a railroad track across the desert. Captain Rostrand of the *Mauretania* recently reported that the saving in the fuel item alone had been determined to be the entire cost of the equipment every few hundred hours of service on the large trans-Atlantic ships.

"To indicate contributions which the gyro compass makes in war vessels, it might be said that when we installed our first compasses, which go down in the secret room of a battleship way below the water line under the protected deck, and where repeaters driven from the master compass perform all the other functions about the ship, six repeaters were all that could be used at the various stations. However, it was soon found that the entire system of fire control could be based upon this instrument with its wonderful persistence and reliability, and so the latest equipments that have been furnished to the navy have called for as many as 40-odd repeater outlets, nearly all of which have to do with the automatic operation of various fire control instruments constituting a base line from which salvo firing can be continuously conducted even behind dense smoke screens and barrages of different sorts, and hits scored on the enemy or targets far over the horizon."

America's progress in industrial research has attracted wide attention abroad, British engineering honors having recently been conferred upon both Mr. Swasey and Mr. Rand in connection with a visit of American engineers who presented the John Fritz gold medal to Sir Robert Hadfield, of London, and Eugene Schneider, of Paris. Engineers said that Germany particularly is watching America's post-war expansion in industrial research with the keenest interest.

Tinkering With Transportation

The plight of Des Moines, Ia., now without street car service, and likely to continue so for some time, is what may happen in many other communities. Scarcely a city in the country has been wise or fair in its political control of street railroads. The voice of the people has been insistent for fares that do not pay cost of operation, and the politicians have acted along the lines of least resistance.

Transportation, quick and convenient, is something every city must have on its streets. Without it the wheels of enterprise will not go 'round. The street cars alone can meet the needs in cities too small for subways and elevated roads. Every business man knows this and is hurt by even temporary cessation of traffic. 'Ere long, realization of the economic necessities of street railroads will come and with it a more unselfish attitude on the part of the chastened public. But already public injustice has made capitalists shy of many enterprises dependent on public favor for protection against political oppression and as a consequence there is likely to be more walking.

THE WEEK'S NEWS

Reports of Important Meetings, Developments and Other Happenings of the Electrical Industry and Its Allied Interests

PLAN SPECTACULAR LIGHTING FOR ELECTRICAL SHOW WEEK.

New York will be treated to something entirely new in spectacular lighting effects when the Electrical Show opens in the 71st Regiment Armory Sept. 28. Illuminating engineers are now working on plans to flood the tall tower of the Armory with light, but just what system of illumination will be used has not yet been decided.

It will probably combine certain features of outline illumination such as was used during the Hudson-Fulton celebration; the jewel effects which were developed for the Panama-Pacific exposition, and floodlighting such as is used at the Statue of Liberty. A battery of searchlights visible from all parts of the city will top the display. The illumination inside the Armory will also be quite different from that customarily employed. The big girders will be hidden by a canvas sky, which will also eliminate the lighting fixtures. Concealed searchlights will throw powerful beams against this sky, and the reflected rays will flood the Armory with brilliant illumination.

OPTIMISM RULES N. E. L. A. EXECUTIVE BOARD MEETING.

Members Report Business Slowly But Surely Reviving in Electrical Industry Throughout Country—Public Relations Committee Meets.

Optimistic reports regarding the outlook for business throughout the country were made by representatives of all Geographic Divisions of the National Electric Light Association who attended a meeting of the National Executive Committee at Association headquarters, Sept. 1. Without exception they declared that apparently the bottom of the slump has been reached and business slowly is on the upgrade. A steady and gradual improvement is noted by practically all companies whose lighting and commercial loads enable them to keep close check upon business conditions.

The following were present at the meeting: President Milan R. Bump, Henry L. Doherty & Co., New York City; Vice-President Frank W. Smith, United Electric Light & Power Co., New York City; Treasurer H. C. Abell, American Light & Traction Co., New York City; Martin J. Insull, ex-officio, Middle West Utilities Co., Chicago; W. E. Robertson, Robertson-Cataract Electric Co., Buffalo; E. W. Lloyd, Commonwealth Edison Co., Chicago; I. E. Moultrop, Edison Electric Illuminating Co. of Boston; E. J. Fowler, Commonwealth Edison Co., Chicago; R. H. Tillman, Consolidated Gas, Electric Light & Power Co., Baltimore; N. A. Carle, Public Service Electric Co., Newark, N. J.; E. Vinet, 601 Power building, Montreal, Quebec; W. C. Lounsbury, Superior Water Light & Power Co., Superior, Wis.; O. H. Simonds, Dubuque Electric Co., Dubuque, Iowa; T. D. Crocker, Minneapolis General Electric Co., Minneapolis, Minn.; W. R. Putnam, Idaho Power Co., Boise, Idaho; A. B. West, Southern Sierras Power Co., Riverside, Cal.; E. A. Phinney, Jefferson County Power & Light Co., Golden, Colo.; A. Hardgrave, American Public Service Co., Dallas, Tex.; Thos. W. Martin, Alabama Power Co., Birmingham, Ala. (representing S. B. Irelan); and by invitation: Alex Dow, Detroit Edison Co., Detroit; R. V. Prather, 305 DeWitt Smith building, Springfield, Ill.; Executive Manager M. H. Aylesworth, N. E. L. A. headquarters, New York City; Engineer W. J. Canada, N. E. L. A. headquarters; superintendent, Service Department, Fred W. Herbert, N. E. L. A. headquarters; Committee Secretary A. Jackson Marshall, N. E. L. A. headquarters; director of publicity, George F. Oxley, N. E. L. A. headquarters; assistant to executive manager, S. A. Sewall, N. E. L. A. headquarters.

Budgets for administrative and general expenses, and for the National Sections, and Geographic Divisions were considered and approved, the plans for Association activities during the year being brought out during the course of discussion of the budgets.

President Bump announced the appointment of the following Committee to represent the Association at the annual convention of the National Association of Railway and Utilities Commissioners: President Milan R. Bump, Messrs. S. Z. Mitchell, O. D. Young, Martin J. Insull, Frank W. Smith, Executive Manager M. H. Aylesworth. He also announced that Executive Manager Aylesworth has been placed upon the program of the Commissioners' convention on Oct. 14. The members of the Committee will be given opportunity to present the electrical utilities' side of questions at round table conferences with the commissioners. The Executive Committee approved the continuation of the good-will publicity and advertising program, including the motion picture undertaking of the Public Relations Section.

The motion picture program and good-will advertising program of the Association were discussed at length at the meeting of the Public Relations National Section Executive Committee at National headquarters, Aug. 31. It was announced that the motion picture program is now well under way, copies of the first film, "Back of the Button," being available for release to member companies. Details of the plan are now being printed and will be forwarded to member companies in the near future.

Announcement was made that the Electrical Securities Committee of the Investment Bankers Association and the N. E. L. A. Committee on Relations with Bankers will co-operate during the

present administrative year. Appointments of committee personnel were announced by Chairman Insull and detailed plans for the work of the Section were discussed and formulated.

NEW YORK PORT DEVELOPMENT PLANS PROGRESSING.

The Port Authority, a commission of six, created last spring by legislation of the states of New York and New Jersey to consolidate all the varied elements affected, and to evolve an interrelated system that would develop and use to their best advantage the great natural resources with which the New York Port District is endowed, has made remarkable progress in its work and this winter will submit its proposed plan to the interested legislatures.

The commission is conducting a campaign of co-operation with chambers of commerce, civic associations, political organizations, women's clubs and other groups of citizens with a view to receiving instructions, criticism, suggestions and support. All available agencies for the dissemination of information regarding the port problem are being utilized and to assist in this purpose an interesting motion picture which pictorially presents the report of the New York, New Jersey Port and Harbor Development Commission upon which is based the study for the final comprehensive plan, has been prepared and is ready for display before clubs and associations.

N. E. L. A. DIVISION TO DISCUSS CENTRAL STATION PUBLICITY.

Joint Meeting of Great Lakes Geographic Division and Indiana Association to Be Addressed by Prominent Men in the Industry.

"Facts and Feelings in Salesmanship," "Consumer Ownership of Utilities" and "Central Station Publicity" are among some of the important matters to be discussed at the first annual convention of the Great Lakes Geographic Division of the National Electric Light Association to be held jointly with the Indiana Electric Light Association at French Lick Springs, Ind., Sept. 21-24. The tentative program thus far arranged by Morse DellPlain, chairman of the Program Committee, follows:

Sept. 21, 9:30 *a. m.*—President's address, William C. Lounsbury, Superior, Wis.; reports of committees; report of secretary-treasurer; address on "Facts and Feelings in Salesmanship" by Dr. A. Holmes, president of Drake University, Des Moines, Ia.; address on "Contract Routine" by R. T. Duncan, Detroit Edison Co.; report on "Investigation Upon the Relation of Kilowatt Hours Sold for Appliances and for Lighting in the Average Household" by T. W. Berger, Philadelphia; address on "Illinois Committee on Public Information and Its Future Plans" by B. J. Mullaney, Chicago, and report on "The Electric Vehicle" by Messrs. Cunningham and Carpenter, Chicago.

Sept. 22, 9:30 *a. m.*—Addresses on "Consumer Ownership of Utilities" by R. F. Schoel, Chicago; "Public Service" by George P. Barnard, Commissioner, Indiana Public Service Commission; "Central Station Publicity" by J. B. Wootan, New York City; "Training for Public Service" by Fred R. Jenkins, chairman, Educational Committee, National Electric Light Association, and an address by M. H. Aylesworth, executive manager, National Electric Light Association.

Sept. 23, 9:30 *a. m.*—Report of Technical Committee by George E. Lewis, Ann Arbor, Mich.; paper on "Michigan High-Voltage Transmission Systems" by H. J. Burton, Jackson, Mich.; report of Meter Committee by J. C. Langdell, Jackson, Mich.; address by N. A. Carle, chairman, Technical Committee, National Electric Light Association; paper on "Distribution Systems in Small Communities" by speaker to be announced later; general discussion on consumers' billing methods led by B. P. Shearon, Hammond, Ind., J. H. Thomas, Peoria, Ill., C. H. Hansberger, Grand Rapids, Mich., H. C. Mitchell, Indianapolis, and W. A. McDonough, Beloit, Wis. There will also be a demonstration of the latest mechanical billing devices.

Sept. 23, 7:30 *p. m.*—Address by Milan R. Bump, president of the National Electric Light Association, and distribution of golf prizes.

PROGRAM FOR INDIANA ELECTRIC LIGHT ASSOCIATION.

Sept. 24, 9:30 *a. m.*—Reports of committees; report of secretary-treasurer; appointment of Nominating Committee; president's address by Morse DellPlain, Hammond, Ind.; address on "Capitalizing Your Opportunities" by William L. Goodwin, of the Society for Electrical Development; address by M. H. Aylesworth, executive manager of the National Electric Light Association; round table discussion; report of Nominating Committee, and election of officers.

CHANGES IN RANKS OF WESTERN ELECTRIC EXECUTIVES.

Several important changes have occurred recently in the executive circles of the Denver and Boston offices of the Western Electric Co. T. L. Holmes has been appointed manager of the Boston telephone distributing house, H. H. Argabrite has been appointed manager of the Denver telephone distributing house, A. C. Cornell has been appointed manager of the Denver supply distributing house, H. W. Dye has been appointed stores manager of the Denver supply distributing house and Jesse Hageman has been appointed credit manager of the Denver supply distributing house.

Mr. Holmes began with the schedule department of the Western Electric Co. at New York in 1900. Four years later he started around the circuit, making his initial stop-off at Kansas City, where for 2 yrs. he wrestled with the returned goods and chief storekeeper's problems. He was drafted to Pittsburgh early in 1906 to follow out the latter line of business and stayed there until December, 1907, when he was made manager of Harrisburg, and a month later of Syracuse. It was only a short jump to his home town and in half a year Mr. Holmes was back in New York as assistant manager of the telephone department.

"Holmes' Sweet Home" failed to hold him very long. May, 1909, saw him back at Kansas City as assistant manager. He jumped across the state a year later to spend 3 mo. putting the St. Louis house through its paces before he went to Chicago for a year's sojourn as manager of that city's telephone department, and another 12 mo. at Hawthorne. He left Chicago in 1912 to become stores manager at Philadelphia, and later at New Haven. Just a few days before we declared war on Germany, Mr. Holmes was appointed manager of the Connecticut house. He went to Denver in July, 1918.

H. H. Argabrite, who has succeeded Mr. Holmes at Denver, showed a partiality to February during his first 4 yrs. with the Western Electric Co. He joined the billing department at Salt Lake City in February, 1905, was transferred to the purchasing department a year later,

celebrated the second month of 1907 by becoming chief clerk and kept it up by adding the storekeeper's title to his possessions a year after that. He broke his intimate connections with the short month in July, 1911, when he went to Denver as stockkeeper. Since then he has been accountant, acting stores manager and stores manager of the Rocky Mountain organization.

A. C. Cornell joined the great electrical concern just 8 mo. after his new associate, Mr. Argabrite, in 1905, and went all through the St. Louis house before he moved to Denver. During his 15 yrs. at the Mound City office he was everything from stock clerk to sales manager of the "Show Me" tribe.

H. W. Dye is the real veteran of Denver's new lineup. It was just 18 yrs. ago that he joined the clerical forces at Chicago. He was transferred to the sales force of the Illinois house in 1905. He spent 2 mo. in the Dallas house in 1908 and then went to the Pike's Peak region where, for 11 yrs. he spread the doctrine of "Quality Products."

Jesse Hageman is the only one of Denver's present executives who really can be called a home product. He has been there for the past 12 yrs. dividing his days between the cashier's cage and the credit department.

Left to Right—H. W. Flake, C. E. Johnson, R. A. Sumbstedt, Robert B. Ely, Westinghouse Lamp Co., and J. R. Stewart.

Addition to Westinghouse Lighting Bureau.

This group contains four of the five illumination engineers who have just been added to the force of the Westinghouse Illuminating Bureau. They have recently completed a course of special training in lighting practice at the Cutter Works of the Westinghouse Electric & Manufacturing Co., South Bend, Ind., and at the Westinghouse Lamp Co., Bloomfield, N. J. The courses of instruction were conducted by L. A. S. Wood at South Bend, and by R. B. Ely at Bloomfield. These men were assigned to staffs of various district offices and will be field representatives for the Cutter Works. H. H. Ashinger was absent at the time the accompanying picture was taken.

NEW YORK UNIVERSITY ORDERS AUTOMATIC SUBSTATION.

In order that its students may keep abreast of the new developments in the electrical industry, the New York University has ordered a 75-kw. synchronous-motor generator set with automatic switching equipment from the Westinghouse Electric & Manufacturing Co. This outfit will be arranged so that it can be started or stopped by push-button stations located at various points around the building. In addition to its use for exhibition purposes it will be used as a source of direct-current energy for the testing buses.

The synchronous motor is a 112-hp., 100% power-factor, 2-phase, 60-cycle, 220-volt, 1200-r.p.m. self-starting machine, and the generator is rated at 75 kw. It is a d-c., 250-volt, 1200-r.p.m., compound-wound, commutating-pole, 2-wire unit.

The apparatus is arranged so that on excessive overload series resistors will be automatically cut into circuit so as to reduce the line voltage to approximately 80% of normal. At the same time an alarm bell will be rung. The New York University feels that this will afford an opportunity of reducing the load without shutting off the laboratory direct-current energy. In case the warning of the alarm bell is disregarded the station will shut down in the time interval necessary to operate the grid thermostats.

MEXICAN INDUSTRIAL PLANTS FAIL TO PAY POWER BILLS.

All efforts to arrive at a settlement of the controversy between S. Pearson & Son, Ltd., owners of the hydroelectric plant situated near Orizaba, Mexico, and the operators of a string of cotton mills and other industries of that region, growing out of the rates charged for power have been unsuccessful. The mill owners have refused to pay the power rates fixed by S. Pearson & Son, Ltd., and the total amount of money now due from this source amounts to approximately 800,000 pesos, equivalent to $400,000 United States currency. Formal notice has been served upon the delinquent users of the electric power that unless they settle the long past due accounts without further delay the electric current will be cut off from their respective plants. If this should be done it will mean the closing down of the

mills and the throwing out of employment of thousands of workers. In some instances mill owners have not paid anything on their electric power accounts for more than 2 yrs., it is asserted. Lord Cowdray of England, formerly Sir Weetman Pearson, is at the head of the firm of S. Pearson & Son, Ltd. The same interests have large oil and other industrial holdings in Mexico.

RADIO ENGINEERS MEET.

At the meeting of the Institute of Radio Engineers held in New York City Sept. 7, a paper on "A Visual and Photographic Device for Recording Radio Signals" was presented by Charles A. Hoxie, of the General Electric Co. The speaker described the performance of this interesting high-speed photographic recorder, and samples of tape from trans-Atlantic signals were shown.

JAPANESE DELEGATION VISITS THE WESTINGHOUSE PLANT.

Members of the Japanese Parliamentary Mission visited the East Pittsburgh (Pa.) works of the Westinghouse Electric & Manufacturing Co. a short time ago. Each member of this delegation is a member of the House of Representatives of Japan and is otherwise prominent in Japanese circles.

E. M. Herr, president of the Westinghouse Electric & Manufacturing Co., and L. A. Osborne, president of the Westinghouse Electric International Co., were recently decorated with the Order of the Rising Sun by the Emperor of Japan.

Japanese Parliamentary Mission on a Tour of Inspection of the East Pittsburgh (Pa.) Works of the Westinghouse Electric & Manufacturing Co.

A CORRECTION.

The article in the ELECTRICAL REVIEW of August 27, 1921, page 324, headed "German Manufacturers Bid for South American Trade" was, through a mistake of the news agency supplying us the information, attributed to Louis M. Nichols, of the International General Electric Co. It should have been attributed to Mark R. Lamb, a New York engineer, who recently returned aboard the Munson liner *Aeolus* from a visit to a number of South American countries.

The next regular meeting of the Atlantic Division of the Electrical Supply Jobbers' Association will be held Sept. 22 at the Bellevue-Stratford hotel, Philadelphia.

PLAN MERGER OF NEW JERSEY UTILITIES.

The New Jersey Power & Light Co., Dover, N. J., has been granted permission by the Board of Public Utility Commissioners to acquire the properties of the Lambertville Public Service Co., Lambertville; Flemington Electric Light, Heat & Power Co., Flemington; and the Newton Gas & Electric Co., Newton. The systems will be merged with that of the purchasing utility. The company has also received permission to issue bonds for $309,000, preferred stock totaling $89,000, and common stock in an amount of $50,300 to effect the merger.

TRANSMISSION LINE PLANNED TO INCREASE POWER SUPPLY.

The Niagara Falls Power Co. is completing plans for the construction of a new transmission line from Niagara Falls to Buffalo, by way of Grand Island, and application has been made to the Public Service Commission for authority to proceed with the work. The new line will reduce the line mileage of the present systems between the two cities by about 10 mi., and is estimated to cost $6,000,000. The new system will be used in connection with increased power supply to be provided by a hydroelectric generating station, ground for which recently was broken.

GENERAL ELECTRIC EMPLOYES GET ADDITIONAL COMPENSATION.

Supplementary compensation for the 6 mo. ending June 30 given by the General Electric Co. to employes in its service for 5 yrs. or more, has been paid to 24,809 employes. The total amount paid was $1,067,989.14. Of this amount approximately 11,130 employes in the works and general offices at Schenectady, N. Y., received $463,716.76, or nearly one-half the total. The remainder was divided among other works of the company, district offices, etc.

Payments were made, as recently announced, in the form of employes' 7% investment bonds. In order to avoid the use of checks for amounts less than $10 and for balances over any multiple of $10, employes' subscription stamps in the denomination of 50 cts. were issued. All employes of the company who had been laid off on account of slack work during the past 6 mo., and who, prior to June 30 of this year had completed a

service period of 5 yrs., will receive the 5% supplementary compensation. All such employes will be paid upon presentation at the payroll department.

WATER POWER DEVELOPMENT IN OKLAHOMA.

Two huge hydroelectric plants have been planned for Oklahoma. Following announcement that the $3,000,000 Mountain Fork river project in McCurtain county has been approved and practically assured, comes the news that plans are under way for construction of a $25,000,000 hydroelectric plant on the Grand river, in Mayes county, near Ketchum.

Oklahoma men are back of the Grand River project. Nearly 55,000 acres of land will be inundated by water, which is to be gathered behind a dam 147 ft. high and 4750 ft. long. The entire output of the big plant is to be sold to one large power distributing company which will distribute it over eastern Oklahoma and possibly to points in Arkansas. The McCurtain county project contemplates a dam 2000 ft. long and 200 ft. high, creating a lake 200 mi. in circumference and 26 mi. long. According to government estimates only about one-tenth of the potential water power possibilities of Oklahoma are now developed.

SAN DIEGO UTILITY TO HAVE NEW ELECTRIC GENERATOR.

Announcement is made that the San Diego (Cal.) Consolidated Gas & Electric Co. will build an addition to its power plant in San Diego to house a new 15,000-kw. (20,000 hp.) turbine. The business of the company has expanded so rapidly that even with the additional capacity provided by the purchase of the street railway company's generating station last winter, available power is no longer adequate to the demands upon the company for service.

The new turbine will be a General Electric 3-phase type and the improvement will include additional boiler capacity, switchboard apparatus, modern coal and ash handling machinery, etc.

TO CONSTRUCT HAULAGE SYSTEM.

The New York and New Jersey Port Commission, following the recent approval of the Edge-Ansorge bill by President Harding providing authority for local harbor work, has preliminary plans under way for the construction of an electrically operated haulage system between New York and New Jersey, with joint terminal stations, for the distribution of food and other merchandise. A grain elevator is also planned. William Willcox is chairman of the commission.

DESIGN PATENT UPHELD.

In a recent decision handed down by the U. S. District Court at Brooklyn, N. Y., the infringement suit of the Robert Findlay Manufacturing Co., Inc., 224 Fifth avenue, New York City, on the patent of the design fixture No. 500 against the Hygrade Lighting Fixture Co. was sustained and an injunction and damages awarded.

Announcement has been made that New York offices of the North American Co., the Wisconsin Edison Co., Inc., and the Milwaukee Electric Railway & Light Co. are now located at 60 Broadway. The general offices of these companies are on the 19th floor, and the treasurer's office and the offices for transfer of stock and coupon collection are on the 18th floor.

COMING CONVENTIONS.

National Exposition of Chemical Industries, Eighth Coast Artillery Armory, New York City, Sept. 12. Secretary, Charles L. Parsons, 1709 G street, N. W., Washington, D. C.

Rocky Mountain Geographic Division of the National Electric Light Association and the Colorado Electric Light, Power and Railway Association. Joint annual convention, Glenwood Springs, Colo., Sept. 19-21. Headquarters, Hotel Colorado. Secretary, Minnie B. W. Baker, 900 Fifteenth street, Denver, Colo.

Association of Iron and Steel Electrical Engineers. Fifteenth annual convention, Chicago, Sept. 19-24. Headquarters, Hotel La Salle. Secretary, John F. Kelly, Empire building, Pittsburgh.

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers. Annual convention. Huntington, W. Va., Sept. 20-22. Secretary, Herbert Smith, 212 Robson-Pritchard building, Huntington, W. Va.

Great Lakes Geographic Division of the National Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 21-23. Secretary, R. V. Prather, 305 De Witt Smith building, Springfield, Ill.

Indiana State Electric Association. Joint meeting with Great Lakes Geographic Division of the National Electric Light Association, French Lick Springs, Ind., Sept. 21-23.

Illuminating Engineering Society. Annual convention, Rochester, N. Y., Sept. 26-29. Headquarters, Powers hotel. General secretary, Clarence L. Law, 29 West 39th street, New York City.

American Electrochemical Society. Meeting at Lake Placid Club, N. Y., Sept. 29-Oct. 1.

New York Electrical Show, 71st Regiment Armory, Park avenue and 34th street, New York City, Sept. 28-Oct. 8. General manager, George F. Parker, 124 West 42d street, New York City.

Cleveland Section of the American Society of Mechanical Engineers. Great Lakes regional meeting, Cleveland, Oct. 3-4. James Guthrie, Fidelity building, Cleveland.

Indiana State Association of Electrical Contractors and Dealers. Annual convention, Indianapolis, Oct. 5-6. Headquarters, Claypool hotel. Secretary, A. I. Clifford, 507 Odd Fellows building, Indianapolis.

Indianapolis Industrial Exposition, Indiana State Fair Grounds, Oct. 10-15, under auspices of the Indianapolis Chamber of Commerce. Chairman, O. B. Iles, Chamber of Commerce building, Indianapolis.

Southeastern Geographic Division of the National Electric Light Association. Annual convention, Chattanooga, Tenn., Oct. 17-19. Headquarters, Signal Mountain Inn. Secretary, Charles A. Collier, Electric and Gas building, Atlanta, Ga.

Electrical Exposition, Auditorium, Milwaukee, Oct. 25-31, under auspices of the Milwaukee Chapter of the Wisconsin State Association of Electrical Contractors and Dealers, in connection with the Third Annual Food and Household Exposition, directed by the Milwaukee Journal.

National Council of Lighting Fixture Manufacturers. Annual convention and Lighting Fixture Market, Auditorium, Milwaukee, Jan. 30-Feb. 4. Secretary, Charles H. Hofrichter, 231 Gordon Square building, Cleveland.

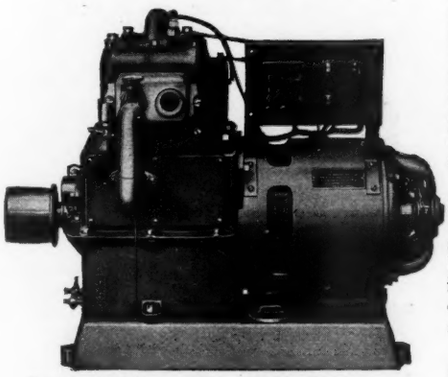
APPLIANCES and DEVELOPMENTS

New, Improved or Interesting Electrical and Mechanical Apparatus and Devices, and Applications of Equipment and Methods in Practice

Farm Lighting Plant With Ford Engine Parts.

In order to facilitate the replacement of the engine wearing parts of its Columbian "C-Y-C" electric generating set, the Columbian Bronze Corp., 522 Fifth Ave., New York City, has made them interchangeable with similar parts of the Ford automobile. The outfit has a single-cylinder, 1200 r. p. m., water-cooled, 5-hp. engine direct-connected with the 1.5-kw., 32 or 110-volt generator to operate with battery for light and power purposes. It uses kerosene for fuel, and extensive tests have shown that the combustion is complete without residue in the cylinder head or valves after long periods of operation, and there is no dilution of the crankcase lubricating oil by the kerosene, according to the statements made.

The engine is equipped with a pulley for line shaft or for power drive, and 2 hp. in mechanical energy may be used



Farm Lighting Plant That Operates on Kerosene.

from this pulley while the battery is being charged. After the battery charging is completed a switch may be opened and the engine relieved of the generator and battery load so that the entire 5-hp. capacity may be used for other power purposes. The unit is simple in design. No fuel pump is required since the fuel feed is entirely by suction from the fuel tank in the base of the outfit, and all lubrication is by splash in the crank case. No carburetor is utilized as the kerosene is fed through a Wilkem metering valve which is essentially a spray nozzle with but one minor adjustment.

Columbia Adds to Its Long List of Products.

The Columbia dry battery lighting outfit, which is in reality a small lighting system for use with dry battery current, is the newest product to be marketed by the National Carbon Co., Inc., Cleveland. This outfit consists of one 6-volt, 2-cp. mazda lamp, 12 ft. of lamp cord, one combination switch and socket, and a sliding hook to hang up the lamp in any convenient place. The parts are completely assembled and neatly packed in a cardboard container.

Unquestionably there is a steady demand the year around for such a device. Heretofore the user was obliged to resort to his own electrical knowledge in

Columbia Dry Battery Lighting Outfit.

order to obtain and assemble the necessary parts that constitute an outfit of this nature. Oftentimes the purchaser would experience difficulty in obtaining all the parts at one store, and if he was not guided correctly, the home-made lighting outfit might not operate efficiently on dry battery current. With the new Columbia lighting outfit it is stated that there is no chance for the purchaser or the dealer to go wrong as this outfit has been given the necessary engineering attention to give correct results.

For use with this outfit the National Carbon Co. recommends its No. 1461, 1561, 1562, 2462, or 2562 Columbia hot shot battery. The 2462 and 2562 Columbia hot shot batteries give longer service than the other three named types and can also be used with two outfits at the same time if desired.

Something New in Christmas Tree Lighting Set.

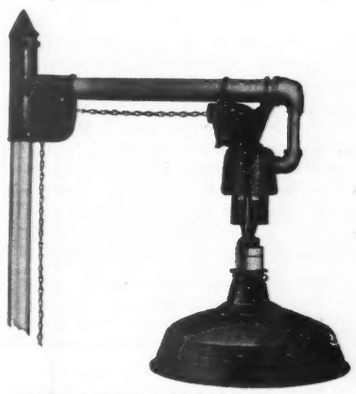
"Add-A-Set" No. 8-80, is the new 8-light Christmas tree lighting outfit put on the market by the Peerless Light Co., of Chicago, New York and San Francisco. These sets can be built up to any size, from 8 to 80 lamps by adding the 8-light units. The arrangement is so simple that any child can build up "Add-

"Add-A-Set" Decorative Lighting Unit.

A-Set" units by merely screwing the plug of one set into the socket of another. If an extra bright light is desired on a tree a standard lamp can be inserted in the end socket. This set is simple in construction, consisting of a Stuart plug and Peerless patent socket, connected to the eight composition husks with green silk cord. The latest type of semi-flame mazda lamp in red, white, blue, green and yellow is included in each set. The holly display carton is not only attractive but compactly devised to conserve space for the dealer during the holiday rush. It is claimed the "Add-A-Set" will eventually become a year-round seller because it can be used for any sort of illuminative purpose—at lawn parties, weddings and other occasions.

Safety and Efficiency Applied to Industrial Lighting.

Industry has come to realize that the best of lighting systems in the factory will soon become inefficient if permitted to remain uncleaned. Dirty lamps and



Underslung Model Safety Hanger.

reflectors in an industrial plant soon reveal themselves in decreased production and increased hazards that swell the casualty list among the employes. Therefore, one of the important items on the efficiency schedule of most factories is the frequent and systematic cleaning of the lighting fixtures. Modern illumination in industrial plants requires the placing of a majority of the lamps and reflectors high above the

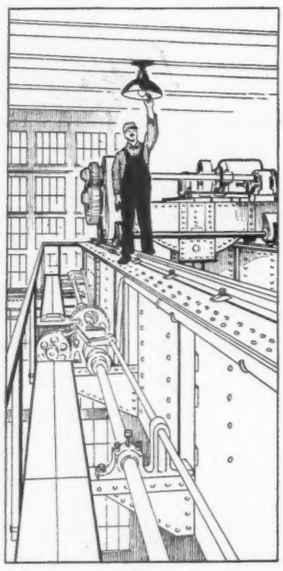
Ladders Are Dangerous and the Method Expensive.

work, suspended in many cases only a few feet—sometimes inches—from the ceiling. The chief method of cleaning has been to mount a tall and unstable

Safe and Economical Method.

ladder or to climb the machinery during a suspension of operations—both dangerous and uneconomical methods.

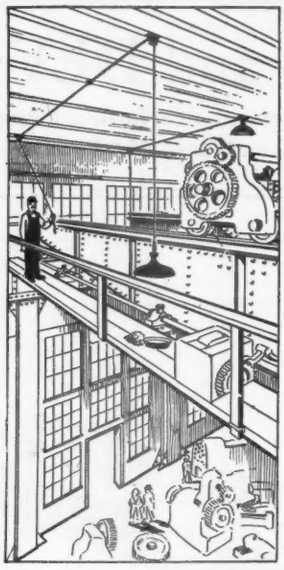
Because clean lamps are a great source of revenue in any factory, and because present methods of cleaning the fixtures are not only hazardous but expensive in wasted time, the Thompson Electric Co., 226 St. Clair avenue, N.E., Cleveland, O., has placed on the market a simple and efficient device known as



This Method Courts Accidents.

the "Thompson Safety Disconnecting Hanger", which enables high lamps to be lowered away from electrical contact and dangerous moving machinery for cleaning and renewals. The company has issued Catalog B-20, which tells about the hangers and the various methods of using them. This catalog will be mailed on request.

With the Thompson hangers installed one man can do the work of three in



Thompson Hanger Over Safety Walk.

keeping the fixtures clean and helping the many large industrial lamps to adequately perform the duty for which they were designed. This cleaning process can go on while the plant is in full operation, without interfering with the work of the men or machines, and without placing the cleaner in jeopardy of life or limb. Thus there is a saving due to efficient lights, another saving because the cleaning process can be carried on without interfering with operations, and still another important item, the saving in damages or loss of employes as the result of accidents under old methods. The illustrations herewith show some old practices which present hazardous conditions, and the safety and efficiency of the system where the Thompson hangers are installed.

One-Piece Adjustable Fixture Wall Bracket.

No hickeys, crowfeet, extension pieces, hacksaws and blades or fittings together with iron pipe, cluster tubing, canopies, slip-rings, etc., are needed when the McPhilben "Adjustable Bracket," made by the McPhilben Lighting Fixture Co., Inc., 264 Fulton St., Jamaica, N. Y., is used. This 1-piece bracket has the canopy and stem solidly rolled together and soldered and the end of the stem is capped by a heavy brass knob tapped to take a threaded bolt, connecting it to the patented support arm concealed inside. About 0.75 in. from the end knob a nipple is soldered and riveted to the stem for attaching the lamp socket. The steel support arm inside of the canopy and stem is threaded on the inner end to fit any standard 0.375-in. pipe thread

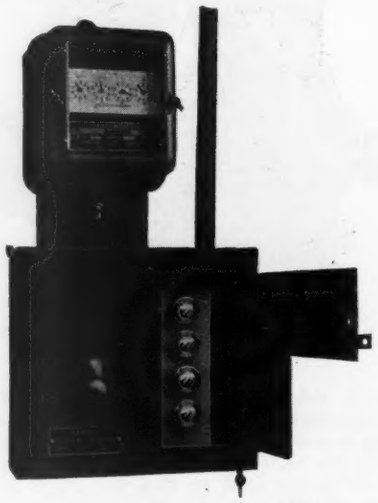
McPhilben Adjustable Wall Bracket.

and, therefore, will fit 0.375-in. gas-pipe, standard fixture studs or outlet boxes.

To install this bracket, screw the support arm and bolt to the stud box and, if the latter is set crooked, bend the support arm until the bolt is at right angles with the wall, before setting the canopy over the support arm. Then put the canopy flush against the wall, screw the end knob on the bolt and tighten up with the fingers. Thus the bracket is not only adaptable to recessed and extending outlet boxes but can be adjusted to rectify the faults of ones improperly set. In addition, the bracket can be fastened directly to the wall by using the support arm as a crowfoot and inserting woodscrews in the holes punched for that purpose. The bracket is strongly constructed of durable materials and the standard finishes are brush brass, white enamel and nickel plate, but special finishes can be obtained upon order. This device has also been inspected and approved by the National Board of Fire Underwriters' Laboratories.

An Entrance Switch for Houses and Apartment Buildings.

The "Kantshok" safety entrance is the name of a device recently placed on the market by the Lewis Electric Co., Canton, O. The company states that this safety entrance is manufactured in various sizes and types, in 2- and 3-pole, and so constructed that it can be



"Kantshok" Safety Entrance.

enlarged by the use of an additional section or sections which are made to interlock with the original unit. Another feature of this device mentioned by the manufacturer is that the "Kantshok" safety entrance is so constructed that when the door is open giving access to the fuses the user is protected from coming in contact with any live or current-carrying parts.

The time-saving features of the "Kantshok" safety entrance are thus set forth by the Lewis Electric Co.: Only one item to carry in stock and transport to the job. Only four screws to drive home and installation is complete. No assemblage on the job. No holes to drill in steel. All current-carrying parts can be replaced from front of device. For apartment-house work it eliminates meter cabinets and meter rooms.

ACTIVITIES IN THE TRADE

Business Developments, Sales Agencies, Trade Literature and Miscellaneous Items Concerning Electrical Manufacturers and Allied Business Interests

Genesee Valley Power Co., Olean, N. Y., has filed notice of dissolution under state laws.

Naumer Electric Co., 96 Beekman street, New York, N. Y., has filed notice of increase in capital to $50,000.

W. P. Price Battery Co., Philadelphia, has leased property at 3310 North Broad street for a new local establishment.

Arthur Wolf, Northampton, Pa., has arranged for the establishment of a new electrical repair works at 206 East 21st street.

College Hill Electric Light Co., Utica, N. Y., has filed notice of increase in capital from $5000 to $100,000 for proposed expansion.

A. L. Nichols Mfg. Co., Poughkeepsie, N. Y., has filed notice of change of name to the Algonquin Electric Manufacturing Corporation.

John F. Lightfoot and David Phillips, Philadelphia, Pa., have been appointed receivers for the Girardville Gas Co., 4014 Chestnut street, with plant in the Girardville section.

Iron City Electric Co., Pittsburgh, has issued a 4-page folder entitled "Violet-Rays," which illustrates and describes the "Violetta" instrument for medical and domestic purposes.

S. Pearson & Son, Ltd., Orixaba, Tex., oil operator, is planning extensions in its hydroelectric generating plant in that section, to include an increased capacity of close to 50,000 hp.

Delta-Star Electric Co., 2453 Fulton street, Chicago, manufacturer of high-tension equipment, has opened a district office at 310 Security building, Minneapolis, in charge of J. E. Sumpter.

Sutton & Stock, 17 North Market street, Mechanicsburg, Pa., electrical contractors, have dissolved their partnership and the business in the future will be conducted by J. Henderson Stock.

Middlesex Lighting Fixture Co., 276 Davidson avenue, Perth Amboy, N. J., filed notice of organization to deal in electrical supplies. Edward J. Mills and Louis Schoenwetter head the company.

Electric Storage Battery Co., 19th and Allegheny streets, Philadelphia, has acquired property at New Orleans, La., for distributing and other service. The building will be remodeled and occupied at an early date.

Schweitzer & Conrad, Inc., 4435 Ravenswood avenue, Chicago, has issued bulletin No. 103-A illustrating and describing its ejector cutout, type E. The company states that this device has been adopted as standard equipment by several large public utilities. It provides a convenient and reliable cutout with disconnecting and quick refilling features. The bulletin states that this cutout "has been developed to meet the demand for a reasonably priced but absolutely reliable transformer cutout for voltages up to 6600. Fuse elements for use in this cutout are made in various capacities ranging from 10 to 100 amperes."

Jondee Electric Co., 48 Williams street, Newark, N. J., filed notice of organization to manufacture and deal in electrical products. J. Dale Dewek, Marlborough Hotel, East Orange, N. J., heads the company.

Wickwire Limestone Co., River Road, Buffalo, N. Y., is planning for the rebuilding of its power plant at the limestone properties at Lockport, N. Y., destroyed by fire Aug. 8, with loss estimated at $30,000.

Multilite Mfg. Co., Philadelphia, is being organized to manufacture electric lighting fixtures and supplies. Application for a state charter will be made. Rose & Fischer, 803-6 Victory building, 1011 Chestnut street, Philadelphia, represent the company.

Logansport Utilities Co., Logansport, Ind., operating a local light, power and heating system, has made application to the Public Service Commission for permission to abandon its heating service or permit increased rates sufficient to defray the cost of operation.

Lion Electrical Mfg. Co., New York City, has succeeded to the business of the Lion Electrical Appliance Co., 360 Morgan avenue, Brooklyn, with New York headquarters at 26 Warren street. The company will manufacture lighting fixtures, electric portable lamps, etc.

Hobart Bros. Co., Troy, O., manufacturer of battery-charging equipment, electric motors, lighting generators, etc., has issued a 4-page folder which illustrates and describes the company's belted battery-charging outfit, especially adapted for garages and for illuminating purposes.

O. C. White Co., 15-21 Hermon street, Worcester, Mass., manufacturer of adjustable electric light fixtures, has recently issued catalog No. 16 illustrating and describing the "White" line of fixtures for banks, business offices, libraries, public buildings, music rooms, living rooms, bedrooms, bathrooms, dressing rooms, theater dressing rooms, hospitals and surgeries, physicians, dentists and oculists offices, drafting rooms, laboratories, technical schools, manual training schools, machine shops, mills and factories.

George Cutter Works of the Westinghouse Electric & Manufacturing Co., South Bend, Ind., has issued a booklet of handy wiring tables and illumination data containing a considerable amount of information which is of interest to anyone connected with the problems of wiring and lighting offices, factories, etc. Tables of foot-candle intensities recommended for different classes of service are included in this booklet, and an interesting discussion of lighting installations is made. Several new devices manufactured by the Westinghouse company are also shown.

Henry Hyman & Co., Inc., 476 Broadway, New York City, manufacturer and distributor of "Hylite" fixture accessory parts and "Best" electrical specialties, has announced the removal of its Chicago office from 25 North Franklin street to 212-216 West Austin avenue.

National Illuminating Appliance Co., 255 West 44th street, New York City, has recently been formed to manufacture art lamps, lighting fixtures and special illuminating products under Henri Raphael Cook's process of making glassware. The shades are translucent, iridescent and artistic and have the effect of a combination of leaded glass, silk and parchment. In addition it is stated that they wear better and withstand rougher treatment than glass or metal without bending or breaking and may be washed, while heat does not injure them. D. C. Rosetahl is the sales manager.

Lumen Bearing Co., Buffalo, N. Y., and Youngstown, O., manufacturer of the well-known line of "Machine-bronze," brass and bronze castings and bearings, solders and babbitts, has, owing to the increase in its activities, found it necessary to locate in Chicago a branch office that will supply and handle all business of the company west of and including Michigan with the exception of the City of Detroit, and west of a line from Toledo, to Columbus to Cincinnati; Kentucky, Tenessee and Georgia. H. S. Huncke is the western sales manager, with Henry Waters as associate salesman. The office is located at 15 North Jefferson street, Chicago.

Berthold Electric Manufacturing Co., 127 South Green street, Chicago, has announced that it has made a reduction in the price of its products and has also added apartment-house and commercial laundry units to its line of domestic washing machines. The apartment-house type is designed to supplant the stationary tubs, usually installed, and consists of a washing unit and a rinsing unit, all connected up with the necessary pipes and control valves. The commercial laundry type consists of three or more washing tubs and cylinders connected in tandem and driven from a single motor. Each cylinder is controlled by a separate lever, thus making it possible to operate all of the washers or any one of them. This machine is supplemented by a double tub and wringer for rinsing and drying the clothes. This line of machines offers the dealer a very much wider field of activity and should attract many of the wide-awake concerns.

PERSONAL MENTION

Biographical Sketches and Chronicle of Changes in Business Connections, Promotions and Other Personal News of the Industry

J. F. STREIB, assistant chief engineer of the Pressed Steel Car Co., Pittsburgh, has been appointed chief engineer to succeed B. D. Lockwood, who has resigned.

A. P. JAHANT, of the Jahant Electric Co., Akron, O., was elected president of the Electrical Contractor-Dealers' Association of Akron at a recent meeting of that organization.

JAMES O. PERRINE has resigned as a member of the faculty of Cornell University, Ithaca, N. Y., to become associated with the American Telephone & Telegraph Co. in an advisory capacity.

R. A. LUNDQUIST, Minneapolis, has been appointed head of the newly created electrical machinery division in the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce.

ISAAC HARTER, assistant to the president of the Babcock & Wilcox Co., 85 Liberty street, New York City, manufacturer of boilers, stokers, etc., has been appointed general superintendent of the company.

F. L. NEWTON, who was formerly connected with the Wichita Falls (Tex.) Electric Co., is now manager of the Meter and Service Department of the Empire District Electric Co. of Oklahoma at Picher, Okla.

LEROY C. WILLIAMS has left his work as sales engineer with the Westinghouse Electric & Manufacturing Co., San Francisco, to accept a position as engineer with the Alberhill Coal & Clay Co., Los Angeles.

WILLIAM H. SEVERNS, assistant professor of mechanical engineering in the extension department of the University of Wisconsin, Madison, Wis., has accepted a similar position at the University of Illinois, Urbana, Ill.

JOHN P. KELLY, Pittsfield, Mass., inspector of safety appliances in the Bureau of Safety of the Interstate Commerce Commission, has been appointed senior mechanical engineer for the Bureau, with headquarters in Washington, D. C.

RICHARD FRANCHOT PAIGE has been appointed secretary-treasurer of The Society for Electrical Development, Inc., 522 Fifth avenue, New York City, to fill the vacancy created by the resignation from that office of James Smieton, Jr.

GEORGE A. IRONSIDE, formerly chief operator and maintenance engineer of the Akitiki Power & Paper Co., Iroquois Falls, Ont., Can., has become assistant superintendent of the Hydro-electric Power Commission at Cameron Falls, Nipigon, Ont.

WALTER W. TEMPLIN, specialty sales manager of the Western Electric Co., 195 Broadway, New York City, has resigned in order to accept the position of vice-president with the Manhattan Electrical Supply Co. He will make his headquarters at the executive offices of the latter concern, 17 Park place, New York City. Mr. Templin has been engaged in sales work for the Western Electric Co. for more than 16 yrs. and at various periods has represented the company in the cities of Chicago, Detroit, St. Louis and New York. In recent years, Mr. Templin, as specialty sales manager, has had general direc-

Walter W. Templin.

tion of the Western Electric Co.'s sales of washing machines, vacuum cleaners, ironing machines, electric ranges, dishwashers, sewing machines and other devices for resale.

MRS. LAURA GARDNER EDWARDS, who for 10 yrs. wrote trade-paper copy, bulletins and other advertising material for the National Tube Co.; then for 2 yrs. had charge of the follow-up correspondence of A. M. Byers Co., and since the first of the year has been assistant to N. Rowland, representative of the Frank Presbrey Agency, has again become affiliated with George Land, Technical Publicity Co., Pittsburgh.

R. W. SCHROEDER, holder of the world's altitude record (33,114 feet), and until recently major, U. S. Air Service, and chief test pilot, McCook field, Dayton, O., joined the staff of the Underwriters' Laboratories Sept. 1 and will take a principal part in the airplane and aviator classification work which the Laboratories are doing for the National Aircraft Underwriters' Association. Major Schroeder's intimate practical experience will assure for this work the object of the founders of the Laboratories—"to secure the best and fairest opinion regarding the merits or demerits of every device, system, machine or material in respect to life and fire hazards." In addition to Major Schroeder, the aircraft personnel of the Laboratories' staff includes: S. V. James, mechanical engineer, for several years chief designer in an extended airplane experimental research work; C. R. D'Olive, holder of distinguished service cross, superintendent of label service, formerly first lieutenant 93rd Pursuit Squadron, A. E. F.; K. G. Leigh, assistant engineer, formerly second lieutenant, pilot and instructor, U. S. Air Service, and E. L. Barrett, assistant engineer, formerly instructor, aviation motor school, U. S. Navy.

VERNON COLE, who graduated from the Massachusetts Institute of Technology in June, has accepted a position as mechanical test engineer with the Duquesne Light Co., Pittsburgh.

JOHN J. CARTY, Plainfield, N. J., has been appointed manager for the New York Telephone Co. at Rutherford, N. J., to succeed W. W. Skidmore, deceased.

C. M. GAILMARD, of the auditing department of H. M. Byllesby & Co., Chicago, has been made a Chevalier of the order of the Crown by King Albert of Belgium for services rendered in the repatriation of Belgian prisoners. As a lieutenant in the American army, Mr. Gailmard acted as aide-de-camp to General Harries, chief of the Allied Commission appointed for the repatriation of prisoners in Germany. General Harries and his staff, including Lieut. Gailmard, were the first foreign officers in Berlin after the armistice. Lieut. Gailmard was cited by General Pershing in 1919 for distinguished and meritorious services rendered at Brest, France.

OBITUARY.

HALSTED BAILEY, a mechanical engineer for the American Bosch Magneto Corp., Springfield, Mass., died Aug. 11, aged 27 yrs. He was a graduate of the Ohio Northern University.

WALLACE D. GLIDDEN, assistant treasurer of the Kewanee Boiler Co., Kewanee, Ill., died recently from heart trouble while on his vacation at a camp near Boulder Junction, Wis.

CHANDLER ROBBINS, formerly president of the Robbins & Myers Co., manufacturer of electric motors, Springfield, O., died Aug. 18 in a hospital at Baltimore of pulmonary embolism. He was 77 yrs. old.

L. D. HOWARD GILMOUR, general counsel and solicitor for the Public Service Corp., Newark, N. J., and one of its organizers, died Aug. 21, at the Newark Memorial hospital, following an operation for appendicitis. He was born at Cape May City, N. J., Oct. 27, 1860, and became connected with the Public Service organization in 1903.

AUGUST A. FRAUENHEIM, president of the Iron City Sanitary Manufacturing Co., Pittsburgh, died Aug. 10, at the age of 55 yrs. For a number of years he was president of the Epping-Carpenter Pump Co., serving in that position until a year ago when the company was consolidated with the Worthington Pump & Machinery Corp.

BUSINESS OPPORTUNITIES

News of Electrical Construction Projects in All Parts of the Country, Proposals Invited, Foreign Trade Openings and New Companies

EASTERN STATES.

Damariscotta Mills, Me.—The Lincoln County Power Co. is said to be planning the rebuilding of its power plant destroyed by fire on Aug. 23, with loss estimated at $100,000, including a damaged portion of the adjoining plant of the Damariscotta Leather Co.

West Pownal, Me.—The Board of trustees, State Hospital, has completed plans for the construction of a powerhouse at the institution, estimated to cost $70,000. Work will be commenced at once.

Boston, Mass.—Downes Lumber Co. has purchased a warf at 406 Albany street, which it will improve at once by an electric crane.

Chelsea, Mass.—H. T. West Co., 126 Liberty street, has awarded a contract to Joslin & Landry, 161 Devonshire street, Boston, for the erection of a 1-story powerhouse at its plant.

Dexter, Mass.—City will erect a transmission line from Dexter to Winfield at an approximate cost of $24,000. Address W. R. Coffey, mayor of Dexter.

Worcester, Mass.—Worcester Electric Light Co., 11 Foster street, has completed plans for the erection of a 2-story machine shop on Webster street, estimated to cost $35,000.

Bridgeport, Conn.—The Porcupine Co., manufacturer of boilers, has awarded a contract to the T. J. Pardy Construction Co., Bridgeport, for the erection of a 1-story plant addition, estimated to cost $30,000.

Hartford, Conn.—Electrical equipment, including motors, controlling devices, etc., will be installed in the plant addition to be erected by the Fuller Brush Co. on property recently acquired. Construction will be commenced early in September, with work estimated to cost $400,000.

New Britain, Conn.—Connecticut Light & Power Co. has work under way on an extensive improvement program in this section, estimated to cost $250,000, including equipment. The work will include a new high-tension system leading from Waterbury to the Black Rock power plant of the company; increasing the line voltage at the power station from 33,000 to 66,000 volts; a new distributing station at Corbin Place for the New Britain district, and other line extensions at this place. A. S. Jourdan is district superintendent.

New Haven, Conn.—The Bigelow Co., 92 River street, manufacturer of boilers, has commenced the erection of a 1-story addition to its plant, 53 by 105 ft., estimated to cost $20,000.

Staffordville, Conn. — Benedict Schwanda & Sons, operating a local button manufacturing plant, have acquired the Garland mill property as a site for the erection of a hydroelectric power plant for local industrial service.

Bradford, N. Y.—Figures have been submitted on the cost of erecting and maintaining a municipally owned electric plant. Address Mayor Spencer M. DeColier.

Buffalo, N. Y.—The Board of Commissioners will install considerable electrical equipment in the addition to be erected at the J. N. Adam Memorial hospital, Perryburg, estimated to cost $1,200,000.

Lancaster, N. Y.—Depew & Lancaster Light, Power & Conduit Co. has been granted permission by the Public Service Commission to build an electric lighting system at Concord, N. Y., with distributing lines for power service.

New York, N. Y.—Considerable electrical equipment, including motors, fans, blowers, general ventilating and heating apparatus, etc., will be installed in the school buildings to be erected by the Board of Education. A construction program has been arranged covering the building of 43 new schools during the next year, with total cost estimated at $25,000,000.

New York, N. Y.—New York Edison Co., Irving place and Fifteenth street, will furnish service for the new Cosmo theater, 176-80 East 116th street, the installation to comprise 2000 lamps, 3000 amperes and 20 hp. motor for general operating service.

New York, N. Y.—Fire recently damaged the equipment and stock of the Russell & Stool Co., 17-27 Vandewater street, manufacturer of marine and electrical fixtures. An official estimate of loss has not been made.

New York, N. Y.—Considerable electrical equipment will be installed in the 3-story plant addition to be erected by the Sinclair & Valentine Co., 611 West 129th street, manufacturer of lithographing inks. Construction will be commenced at once. It is estimated to cost $100,000.

Olean, N. Y.—The Common Council is considering tentative plans for the construction of a municipal electric power plant, and a movement for the installation has been commenced by local citizens.

Sand Lake, N. Y.—Wynantskill Hydroelectric Co. has been granted permission by the Public Service Commission to issue bonds in the sum of $4500 for the construction of a local distributing system and street-lighting system. The installation will be made at an early date.

Syracuse, N. Y.—Considerable electrical equipment, including motors, etc., will be installed in the 1 and 2-story plant to be erected by the Meldrum-Gabrielson Corp., Industrial building, on West Fayette street, to be used for the manufacture of milling machines. It will be 60 by 160 ft., and is estimated to cost $75,000.

Camden, N. J.—Electrical equipment, including motors, etc., will be installed in the foundry addition to be erected by the Lutz Co., 31st street and Grays Ferry avenue, Philadelphia, on Hayes avenue. It will be one story, 81 by 120 ft.

Jersey City, N. J.—The power plant of the Vulcan Iron Works, Hudson and Essex streets, was destroyed with other buildings by fire Aug. 22, with total loss estimated at $250,000. The works will be rebuilt. The company is operated by the Grymes Engineering & Vulcan Iron Works Co., of which A. J. Grymes is president.

Lake Denmark, N. J.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has taken bids for extensions and improvements in its local power plant. The work will be placed under way at an early date.

Allentown, Pa.—Electric motors and other equipment will be installed in the printing plant to be erected by H. Ray Haas & Co., Hunsicker building, at Madison and Early strets, to be 2-story and basement, and estimated to cost $50,000.

Allentown, Pa. — Wenz Granite Quarries Co. is completing the installation of a powerhouse at its local stone quarries. Hoisting equipment, air compressors and other apparatus are also being installed.

Harrisburg, Pa.—The State Highway Department is planning for the installation of lighting standards in the vicinity of Capitol park, and for ornamental lighting standards at driveway entrances at Third street, Walnut street and other entrances.

McKeesport, Pa.—The Board of Directors, McKeesport hospital, will take bids at once for the erection of a 4-story powerhouse at the institution, in connection with a nurses' home building, estimated to cost $350,000. Sidney F. Heckert, Pittsburgh, is architect.

Morrisville, Pa.—Considerable electrical and mechanical equipment will be installed in the proposed filtration plant to be constructed at the local waterworks. The Borough Council is arranging for a bond issue of $72,000 for the work.

Pittsburgh, Pa.—Oliver Iron & Steel Co., Tenth street, is completing foundation work for the powerhouse at its works, to be 40 by 80 ft.

Pittsburgh, Pa.—Standard Underground Cable Co., Westinghouse building, has awarded a contract to the J. W. Cowper Co., Oliver building, for the erection of an addition to its plant on Sixteenth street, to cost about $15,000.

Baltimore, Md.—Considerable electrical equipment will be installed in the plant to be constructed by the Adamantex Brick Co., Arbutus, near Baltimore. It will be 2-story, 160 by 268 ft., and is estimated to cost $150,-

000. The company was recently incorporated with a capital of $1,000,000; Louis F. Ducker is president. It is represented by Blum & Makover, Equitable building.

Baltimore, Md.—The City Electrical Bureau has plans under way for the installation of an electrical conduit system on Guilford avenue, from 33rd street to University Parkway, and on 25th street, from Greenmount avenue to Harford road.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co., Lexington building, has sold a preferred stock issue of $2,500,000, the proceeds to be used for general financing and operations, extensions, improvements, etc. Herbert A. Wagner is president.

Baltimore, Md.—Considerable electrical and mechanical equipment will be installed in the new plant additions to be erected by the Western Maryland Dairy Co., 1111 Linden avenue, estimated to cost $500,000.

Oxford, Md.—The Town Commissioners are contemplating the issuance of $18,000 bonds for the construction of an electric light plant.

Washington, D. C.—Potomac Eletric Co., 231 Fourteenth street, N.W., has received permission from the District Board of Public Utilities Commisioners to issue bonds for $2,600,000, the proceeds to be used for general operations and financing, extensions, improvements, etc.

Roanoke, Va.—Considerable electrical equipment will be installed in the addition to be erected at the local plant of the Vicose Co. of America, manufacturer of artificial silk, estimated to cost $1,000,000.

Yorktown, Va.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will take bids at once for the installation of power equipment at the Government power plant at Yorktown. New cranes will also be installed at the yard.

Chelyan, W. Va.—Chelyan Electric Water & Ice Co., S. A. Lewis, president, has applied for a franchise to establish an electric light and power system.

Morgantown, W. Va.—The Hess Coal & Coke Co. will install new electrical equipment at its properties. About $45,000 will be expended for improvements.

Greenville, N. C.—The City Water and Light Commission will expend $12,500 to install a lighting system. Address Edward E. Williams, superintendent.

Springfield, Ga.—The City Council is perfecting plans for the installation of a municipal electric power plant, with machinery installation estimated to cost $25,000. L. B. Ackerman, Jr., is mayor.

Jacksonville, Fla. — Considerable electrical equipment will be installed in the proposed local plant of the Tidewater Glass Co., estimated to cost $300,000. The company recently was incorporated with a capital of $1,150,000, and is headed by C. H. Dankworth and Harry A. Neff. It is represented locally by B. R. Kessler, secretary, Chamber of Commerce.

Key West, Fla.—Key West Electric Co. is planning extensions and improvements in its electrical generating plant to cost about $125,000. New machinery will be installed, including engine, generator and auxiliary apparatus. B. L. Grooms is general manager.

Merritt, Fla.—Merritt Island Light & Power Co., recently organized, will secure power from the Cocoa Light & Ice Co. and construct a local plant for distribution throughout this district. O. R. Grosse is president and A. L. Buck, secretary and treasurer.

Orlando, Fla.—Considerable electrical and mechanical equipment will be installed in the pulp and paper mill to be constructed at Orlando by the Industrial Mfg. Co., Indianapolis, Ind.; the plant is estimated to cost $3,000,000. George A. Weaver is president.

Pensacola, Fla.—Reed Bingham and associates have received permission from the Federal Power Commission to build a hydroelectric generating plant on the Perdido river. A total of five dams will be constructed to provide the necessary water head. Preliminary plans for the work are under way.

NORTH CENTRAL STATES.

Ashtabula, O.—Bids will be received Sept. 14 for the construction of the superstructure of the municipal electric plant. Specifications may be obtained from Stone & Webster, Inc., 147 Milk street, Boston. Address M. H. Turner, city manager.

Kenmore, O.—Considerable electrical machinery will be installed in the proposed match manufacturing plant to be erected by the Palmer Match Co., Ninth floor, Second National Bank building, Akron, O., on a site near Kenmore, estimated to cost $1,000,000. The company was recently organized with Charles H. Palmer as president.

Lima, O.—The fire department wires will be placed in conduits. Address D. W. Dorris, of the City Commission.

Iron Mountain, Mich.—The street car line will be extended.

Lansing, Mich.—The City Council has plans nearing completion for the erection of a municipal electric power plant, with initial capacity of 55,000 kw., estimated to cost $1,650,000. Woodwell & Resler, 501 Fifth avenue, Lansing, are engineers. A. A. Parsons is city clerk, City Hall.

Owosso, Mich.—Plans have been prepared for a $50,000 building to be erected by the Union Telephone Co. Address W. J. Melchers, general manager.

Angola, Ind.—The Board of School Trustees has completed plans for extensions and improvements at the local powerhouse used for school service.

Carlisle, Ind.—The Knox & Sullivan County Light & Power Co., has made application to the Public Service Commission for permission to install and operate electric lighting systems at Carlisle and Oaktown. Authority to issue stock for $25,000 has also been requested.

Hartford City, Ind.—The Board of Blackford County Commissioners will install an electric lighting system at the county infirmary.

Indianapolis, Ind.—The Board of County Commissioners has plans under way for extensions and improvements in its local 2-story power plant used for county institutions.

Peru, Ind.—The Board of Education will make extensions and improvements in the central power house, used for local schools, to cost about $40,000.

Carrolton, Ill.—The city is contemplating the erection of a municipal electric light plant to cost $90,000. Address M. E. McMahon.

Springfield, Ill.—Bonds to the amount of $400,000 have been voted for the purchase of an electric light plant. Address Oscar Beecker, city clerk.

Villa Ridge, Ill.—This town has subscribed $2000 of stock of the Ullin Power & Light Co., which will put in a transformer station and install the poles and wires for an electric light system.

Weldon, Ill.—An election will be held to decide the question of establishing a municipal light plant. Address the mayor.

Fond du Lac. Wis.—The extension of the "white way" from Arndt street north to within 200 ft. of the entrance to Lakeside park has been provided for through an order placed by the city for 77 lamp standards. The Massey Co., of Milwaukee, has been given the contract to provide the standards which will be of the single globe type.

Kiester, Minn.—At a special election bonds were voted for an electric lighting system. Address O. E. Hammerstad, city clerk.

Moorhead, Minn.—The city council rejected all bids for light posts and fixtures on Fifth avenue, South, between Fourth and Eighth streets. Address C. I. Evanson, mayor.

Vergas, Minn.—Bonds have been voted for the extension of a high-power line from Vergas to connect with the Ottertail Power Co.'s line at Frazee.

Greenfield, Ia.—Pickett & Thompson were awarded a contract for the erection of the Winterset electric light plant. The total cost will be $78,915.49.

Bower Mill, Mo.—Lightning ruined the large dynamo used for the generation of power in the Electric Light Co.'s powerhouse.

Columbia, Mo.—The Board of Directors, University of Missouri, is completing plans for the proposed 1-story and basement power plant at the institution, estimated to cost $150,000. Professor Guy D. Newton of the University, is engineer for the work.

St. Louis, Mo.—Electrical equipment will be installed in the addition to be erected at the plant of the Midwest Piping Co., 1452 South Second street, to be 40x150 ft.

Bluff City, Kans.—City will construct transmission line from Bluff City to Anthony. Engineers, W. B. Rollins & Co., 209 Railway Exchange building, Kansas City, Mo. Address Mayor C. W. Duncan.

Clay Center, Kans.—United Light & Power Co., of Abilene, Kans., has purchased the Clay Center light plant and will expend $150,000 for improvements.

Dexter, Kans.—The Common Council has approved a bond issue of $24,000 for the construction of a trans-

mission line for power service to the municipality. W. B. Rollins, 209 Railway Exchange building, Kansas City, Mo., is engineer.

Leavenworth, Kans.—The Federal penitentiary has plans under way for extensions and improvements in the power plant at the institution to cost about $115,000, including new boilers and other equipment.

McCracken, Kans.—Estimates are being prepared and an election will be held to vote on the question of issuing power plant bonds. Address City Manager Ryan.

Quinter, Kan.—The Common Council has completed plans for the installation of machinery and equipment at its municipal electric power plant. New generating units, switchboard and other electrical apparatus will be installed. The Ruckel Engineering Co., Hutchinson, Kans., is engineer.

Deshler, Neb.—Deshler Light & Power Co. will construct a transmission line for farmers.

Madison, Neb.—Henningson, Engineering Co., National building, 12th and Harney streets, Omaha, has made estimates for the erection of a municipal lighting plant to cost $70,000. Address the city clerk.

Beresford, S. D.—A new engine will be placed in the electric light plant to increase its facilities.

LaMoure, N. D.—The Dakota Utilities Co. will construct a transmission line from LaMoure to Verona.

Faulkton, S. D.—An election will soon be held to decide the question of electric lights.

SOUTH CENTRAL STATES.

Lexington, Ky.—Commercial Coal Mining Co. is planning installation of new electrical machinery on coal properties recently leased in this section.

Lexington, Ky.—Lexington Utilities Co. has disposed of a bond issue of $560,000, the proceeds to be used in part for extensions, improvements, etc.

Nashville, Tenn.—O. K. Electric Co., recently organized, will operate an electric system in this vicinity and the city. F. A. Drennon heads the company.

Bastrop, La.—The City Council has plans under way for the erection of a municipal electric light and power plant to cost about $35,000.

Crowley, La.—The Borough Council has plans under way for the installation of new engines and other equipment at the municipal power plant.

Monroe, La.—The Board of City Commissioners will soon commence the installation of additional machinery at the municipal electric power plant for increased capacity.

New Orleans, La.—New Orleans Railway & Light Co. contemplates improvements to cost $545,500, including additional transmission lines costing $120,000, a 1000-kw. rotary magazines station costing $40,000, a $50,000 switchboard, six 1000-kw. transformers costing $60,000, etc. Address A. B. Patterson, superintendent.

Healdton, Okla.—Bonds have been voted to cover the cost of the construction of the municipally owned electric light plant. Construction will commence soon. Address Mayor Langston.

Pawhuska, Okla.—A special election will be held at once to vote bonds for $113,000 for extensions and improvements in the municipal electric power plant.

Tulsa, Okla.—The City Council is planning construction of a municipal electric light and power plant. C. E. Briggs is city engineer.

Tulsa, Okla.—Considerable electrical machinery will be installed in the proposed oil refining plant to be constructed by the Producers' & Refiners' Corp.

Abilene, Tex.—Considerable electrical and mechanical equipment will be installed in the proposed refrigerating plant to be constructed by the Abilene Fruit & Vegetable Co.

Dallas, Tex.—The Dallas Railway Co. will soon commence the construction of an electric traction line, from Dallas to Terrell, about 30 mi. The new road is estimated to cost $1,500,000, including electrical and other equipment. C. W. Hobson is vice-president.

Denison, Tex.—The Kingston light and ice plant was destroyed by fire recently, with a loss of $25,000. Address I. C. Bower, owner.

Mexia, Tex.—Considerable electrical equipment will be installed in the proposed oil refinery to be constructed on a local site by C. H. Foster, Breckenridge, Tex., and associates. A site has been acquired and the initial plant is estimated to cost $400,000.

Moulton, Tex.—Edward Boehm and F. T. Fehrenkamp are organizing a new company to construct and operate a local electric power plant and system. An ice-manufacturing plant will also be erected.

Waxahachie, Tex.—Texas Oil Products Co. will expend about $750,000 for an oil refinery, including powerhouse, electrical machinery, etc. Work will be placed under way at once.

WESTERN STATES.

Denver, Colo.—Bids will be received Sept. 15 by the Board of Capitol Managers on electrical apparatus for the state capitol, museum and state office building. Plans may be procured from the architects, Wm. N. Bowman Co., 914 to 918 Central Savings Bank building. Address Wm. K. Burchnell, secretary.

Miles City, Mont.—Civil Engineer H. K. Doane will map out a preliminary survey of the Buffalo rapids for hydroelectric possibilities and forward same to Mr. Scotten, consulting engineer of Butte. The work is under the direction of Leighton Brothers.

Boise, Idaho.—The Dead Ox Flat Irrigation District has purchased a site on Payette river for a power plant.

Salt Lake City, Utah.—Application has been filed for the development of 1500 hp. on the Little Cottonwood creek in Salt Lake county, by A. H. Cowie.

Salem, Ore.—Improvements to the by the Oregon Pulp & Paper Co. for the development of water power of North Mill creek by the construction of a dam across the creek. Upon completion, the powerhouse will be erected.

INCORPORATIONS.

Poughkeepsie, N. Y.—A. L. Nichols Manufacturing Corp. Capital, $50,000. To manufacture and deal in electrical equipment. Incorporators: C. F. Malcolm, J. W. Allgaze and F. E. Hamilton, 61 Broadway, New York City.

Boston, Mass.—Electric Highway Signal Co. Capital, $10,000. To manufacture electrically-operated signal devices. Rishton T. Bailey, Massachusetts avenue and Tannery street, Cambridge, Mass., president and treasurer.

Bethel, Me.—Mechanical & Electrical Mfg. Co. Capital, $100,000. To manufacture electrical equipment, mechanical specialties, etc. Theodore Morin, Bethel, president and treasurer.

New York, N. Y.—Martalex Electric Corp. Capital, $20,000. To manufacture and deal in electrical products. Incorporators: F. Raab, C. L. Grad and F. Demovitch. The company is represented by Joseph, Demov & Feinstein, 277 Broadway.

New York, N. Y.—Mutual Electricians, Inc. Capital, $5000. To operate an electrical contracting business. Incorporators: K. K. Porter, G. Eisenberg and W. H. Hurtle. The company is represented by Otterburg, Steindler & Houston, 200 Fifth avenue.

Newark, N. J.—Tousek Engineering Corp. Capital, $100,000. To manufacture electrical devices. Incorporators: Paul Bernath, Emil A. Kern and Edward B. Tousek, 228 Jelliff avenue.

Newark, N. J.—Essex Electric Supply Co. Capital, $100,000. To manufacture and deal in electrical appliances. Incorporators: Emanuel D. Lasher, Morris and Harry J. Levy, 277 Market street.

Brooklyn, N. Y.—Instantaneous Electric Water Heater Corp. Capital $5000. To manufacture electric water heaters, etc. Incorporators: M. Holland, L. Feinman and S. Rubinton, 32 Court street.

Taylorsville, Ky.—Taylorsville Electric Co. Capital, $16,000. Incorporators: H. W. Mayfield, Clara Mayfield, Ludlow and E. S. Mayes, Springfield.

FOREIGN TRADE.

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Appliances (35,357) — A doctor in Syria wants to obtain illustrated catalogs and price lists with a view to purchasing electrical medical appliances, especially X-ray supplies; also ice-making machines suitable in size and power for hotels, hospitals and homes. Quotations should be given c. i. f. Alexandretta and Beirut. Payment, cash against documents.

Electrical Apparatus (35,360) — A mercantile firm in Italy wishes to secure an agency for the sale of electrical apparatus and fixtures. Quotations should be given c. i. f. Genoa or Naples. Terms to be arranged through American banks. References.

FINANCIAL NEWS

Comment on the Financial Outlook in the Electrical Industry, New Securities, Reports of Earnings, Dividends and Utility Stocks

Earnings of American Light & Traction Co. and Subsidiaries.

An official of the American Light & Traction Co. states that gross business is keeping up at a very satisfactory rate, in fact showing an increase over last year in the face of general depression in all industrial lines. Operating conditions are also improving, he says, due to the lower cost of fuel and labor.

Net earnings of the company and its subsidiaries available for dividends and depreciation amounted to $315,499 for July of this year, against $181,701 in July, 1920, an increase of $133,798. For the 3 mo. ended July 31, 1921, this item totaled $988,851, which compares with $616,485 earned during the corresponding period of last year.

North American Co.

The consolidated income account of the North American Co. and subsidiaries, for the 6 mo. ended June 30, 1921, shows income after expenses, taxes, interest and other charges of $3,169,404, equivalent after dividends on preferred stock of subsidiaries to $10.64 a share on the $29,793,300 capital stock. The consolidated income account for the 6 mo. ended June 30, 1921, follows:

Gross earnings	$19,622,781
Operating expenses, federal taxes	13,904,394
Operating income	5,718,367
Other income	197,262
Total income	5,915,649
Interest, dividends, etc.	2,746,245
Income for period	3,169,404
Surplus Jan. 1, 1921	11,063,630
Sundry net income	90,222
Total surplus	14,323,256
Reserves depreciation and dividends	2,439,693
Profit and loss surplus June 30, 1921	11,883,563

Northern Ohio Elec. Corp. and Subsidiaries.

	1921.	1920.
July gross	$ 704,107	$ 903,028
Net after taxes	164,136	165,922
Surplus after fixed charges	21,272	24,757
Deficit after preferred dividends	8,727	5,242
7 mo. gross	5,115,937	6,562,239
Net after taxes	1,158,520	1,680,578
Surplus after fixed charges	117,008	747,277
Deficit after preferred dividends	92,991	*537,277

*Surplus.

Lake Shore Electric Railway System.

	1921.	1920.
June gross	$ 213,149	$ 289,351
Net after taxes	36,027	73,916
Surplus after interest charges	360	38,653
6 mo. gross	1,250,035	1,583,424
Net after taxes	167,720	370,457
Deficit after interest charges	43,094	*159,279

*Surplus.

Adirondack Power & Light Corp.

	1921.	1920.
July gross	$ 358,925	$ 374,806
Net after taxes	104,873	47,257
Surplus after interest charges	31,157	*5,741
12 mo. gross	4,782,001	4,313,436
Net after taxes	1,390,943	1,357,782
Surplus after interest charges	492,449	744,366

*Deficit.

Note—12½% of gas and electric revenue is included in operating expenses to cover maintenance charges, credits, etc.

Commonwealth Power, Railway & Light Co. and Subsidiaries.

	1921.	1920.
July gross	$ 2,447,556	$2,546,612
Net after taxes	734,618	490,054
Surplus after charges	94,314	*94,601
Balance after preferred dividends	4,549	*184,366
7 mo. gross	18,221,378	17,550,990
Net after taxes	5,975,632	5,133,621
Surplus after charges	1,618,846	1,113,340
Balance after preferred dividends	990,491	484,935

*Deficit.

Duquesne Light Co. and Subsidiaries.

	1921.	1920.
July gross	$1,234,799	$1,173,651
Net after taxes	393,021	311,429
7 mo. gross	9,539,634	8,408,948
Net after taxes	3,333,171	2,602,995

New England Co. Power System.

	1921.	1920.
June gross	$ 427,406	$ 486,254
Net after taxes	112,703	136,861
Surplus after charges	37,863	69,121
12 mo. gross	5,783,345	5,162,192
Net after taxes	1,729,831	1,545,312
Surplus after charges	864,906	775,253

Illinois Bell Telephone Co.

For the 6 mo. to June 30 gross was $17,032,260; net, $2,827,380, or at the annual rate of 7.27% on the average property valuation of $77,777,327.

American Light & Traction Co. and Subsidiaries.

The company and subsidiaries report net earnings available for dividends and depreciation for July were $315,499, an increase of $133,798, or 73.6%, and for the 3 mo. ended July 31 last net was $988,851, an increase of $372,366, or 60.4%.

Utah Securities Corp. Subsidiaries.

	1921.	1920.
July gross	$ 656,532	$ 668,377
Net earnings	285,788	294,409
12 mo. gross	8,775,552	7,986,930
Net earnings	4,156,162	3,845,574

Consumers Power Co. and Michigan Light Co.

	1921.	1920.
July gross	$1,061,646	$1,128,462
Net after taxes	366,339	204,354
Surplus after charges	165,198	34,867
Balance after preferred dividends	94,676	*29,713
7 mo. gross	8,197,000	7,934,355
Net after taxes	3,248,814	2,370,350
Surplus after charges	1,916,561	1,199,998
Balance and preferred dividends	1,432,738	748,401

*Deficit.

Earnings of Standard Gas & Electric Co. Utility Subsidiaries.

Gross and net earnings reports from various utility subsidiaries of the Standard Gas & Electric Co., for the 12 mo. ended July 31, 1921, are given as follows:

	12 mo. ending July 31, 1921.	Increase over previous 12 mo.
Mobile Electric Co:		
Gross earnings	$ 738,231	$ 23,999*
Net earnings	235,898	22,372
Fort Smith Light & Traction Co.:		
Gross earnings	1,067,642	75,841
Net earnings	298,496	7,648
Puget Sound Gas Co.:		
Gross earnings	169,384	14,114
Net earnings	25,456	934*
Tacoma Gas & Fuel Co.:		
Gross earnings	591,846	72,591
Net earnings	106,177	7,784
Louisville Gas & Electric Co.:		
Gross earnings	4,815,062	733,866
Net earnings	2,186,260	188,245
San Diego Consolidated Gas & Electric Co.:		
Gross earnings	3,405,121	980,257
Net earnings	983,555	132,288
Mountain States Power Co.:		
Gross earnings	964,429	87,233
Net earnings	282,417	3,076*

*Decrease.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. rate. Per cent.	Bid Aug. 29.	Bid Sept. 6.
Public Utilities—			
Adirondack Electric Power of Glenns Falls, common	6	9¼	8½
Adirondack Electric Power of Glenns Falls, preferred	6	69½	70
American Gas & Electric of New York, common	..	104	100
American Gas & Electric of New York, preferred	6	37½	37½
American Light & Traction of New York, common	..	93½	93½
American Light & Traction of New York, preferred	6	78	79
American Power & Light of New York, common	4	55½	55½
American Power & Light of New York, preferred	6	66	65½
American Public Utilities of Grand Rapids, common	..	7	9
American Public Utilities of Grand Rapids, preferred	..	..	17
American Telephone & Telegraph of New York	9	..	106
American Water Works & Elec. of New York, common	..	3½	4
American Water Works & Elec. of New York, particip	7	7½	8
American Water Works & Elec. of New York, 1st pre.erred	..	46	46½
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	30	30
Cities Service of New York, common	+extra	112	118
Cities Service of New York, preferred	6	44	44
Commonwealth Edison of Chicago	8	109	108½
Comm. Power, Railway & Light of Jackson, common	..	10½	10
Comm. Power, Railway & Light of Jackson, preferred	6	28½	28
Federal Light & Traction of New York, common	..	6½	7
Federal Light & Traction of New York, preferred	..	42	41
Northern States Power of Chicago, common	..	36	42
Northern States Power of Chicago, preferred	ex.div.7	79	79½
Pacific Gas & Electric of San Francisco, common	..	55	54½
Public Service of Northern Illinois, Chicago, common	7	80	79
Public Service of Northern Illinois, Chicago, preferred	6	80	80
Standard Gas & Electric of Chicago, common	..	8½	8
Standard Gas & Electric of Chicago, preferred	8	34½	34
Tennessee Railway, Light & Power of Chattanooga, common	..	¾	¾
Tennessee Railway, Light & Power of Chattanooga, preferred	6	3½	3½
Western Power of San Francisco, common	..	25½	25½
Western Union Telegraph of New York	..	81⅜	82½
Industrials—			
General Electric of Schenectady	8	111¼	123
Westinghouse Electric & Mfg. of Pittsburgh, common	7	40	43½